

**THE DEVELOPMENT OF AGREED LEARNING
OUTCOMES AND THE ASSOCIATED USE AND
PERCEIVED VALUE OF A REFLECTIVE
E-PORTFOLIO IN A SPECIALIST
ORTHODONTIC TRAINING PROGRAMME**

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Thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

School of Dentistry
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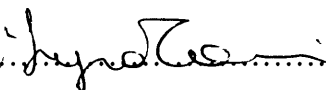
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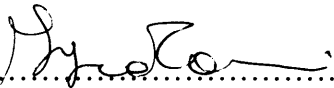
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Abstract

AIMS

To achieve consensus on learning outcomes and assessment among staff members within the postgraduate orthodontic programme in Cardiff.

To highlight students' and mentors' attitudes to the introduction of a reflective e-portfolio used as a formative and summative assessment tool for reflective abilities, professionalism and learning outcomes in the postgraduate orthodontic programme in Cardiff

METHODS

A 2-round modified Delphi process was employed to achieve staff members' consensus with regards to the learning outcomes and assessment methods, which initially were defined according to the literature.

A 2-stage evaluation research approach was chosen to study the implementation of the e-portfolio in the orthodontic training programme in Cardiff. The e-portfolio was piloted for two months and supervisors' and students' opinions on its content, format and impact on learning were collected from questionnaires. The possibility of using the e-portfolio as an assessment tool was identified by means of mentor interviews and student focus groups after piloting it for one academic year.

RESULTS

The staff members' consensus achieved in the Delphi process was 98.4% for the learning outcomes and assessment. From the analysis of the first pilot data, supervisors and students showed equal technical difficulties with the e-portfolio, but supervisors expressed more positive support of the e-portfolio as a learning experience compared with students who had more reservations. The second pilot underlined the students' and mentors' support for the use of the e-portfolio as a formative and summative assessment tool for students' reflective skills, professionalism and learning outcomes.

CONCLUSION

A modified Delphi technique facilitated the process of curriculum revision of the orthodontic specialist training programme in Cardiff.

The use of the orthodontic e-portfolio as a learning and assessment tool might depend on changes in the structure of the portfolio, in the traditional system of assessment and in the thinking of the persons involved and responsible for its delivery.

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Chapter 1 Introduction

1.1 Background

Nowadays professionals who work in the health field need to confront themselves with patients who are increasingly knowledgeable and assertive, to apply theoretical knowledge in the real world and new findings and evidence in day-to-day practice, and to collaborate with other health professionals in ever larger teams. Specific competences are not enough to deal with these complexities; doctors, dentists and nurses need generic competences to enhance effective communication, organisation, teamwork and professionalism.

In Competence-Based Education (CBE) there is a new concept of learning, defined holistic learning, which underlines the production and use of specific and generic competences. The concept of holistic learning requires the integration of knowledge from multiple settings, supporting the importance of the connectivity between academic life and work life as already explained by Gibbons et al. (1994) cited in Jackson and Ward (2004).

Yip and Smales (2000) described the four different aspects of CBE for dentistry. The change from a teacher-centred curriculum to a student-centred curriculum represents one of these aspects. The second aspect is the early identification, at the programme planning stage, of the clearly specified outcomes of learning. Patient care is the primary responsibility of health professionals. Learning outcomes or statements of competence represent the achievements without which a professional would be unable to provide basic care and without which patient safety could not be assured. They are what students are expected to learn to work in the real world.

The definition of learning outcomes or statements of competence also encourages the achievement of minimum standards (ACTDP 1995; Bologna_Declaration 1999; DentEd 2001; Global_Congress_in_Dental_Education 2002; Plasschaert et al. 2005). All persons are entitled to be assured that health professionals practising in the European Union possess the basic knowledge and skills essential for the patients' protection and safety.

The acquisition of the learning outcomes or statements of competence may be achieved through the diversity of educational and training programmes. However the third aspect of CBE is that instructional methods are useful for students in order to acquire the mental processes necessary for learning (Yip and Smales 2000). Educational programmes should be interactive, related to experience and include reflective components. By including these components, learners are given more autonomy and are encouraged to take charge of their own learning (Adult, self-directed learning) (Snadden and Thomas 1998b).

The fourth aspect in CBE is assessment, which should highlight students' progression and achievement of all the learning outcomes or statements of competence of the programme (Yip and Smales 2000). It should be a holistic, continuous, formative and summative assessment of performance that should become more appropriate to the realistic needs of the context moving from the educational environment to the real word of patient care. Furthermore, in CBE, the assessment of the process of learning should be considered as important as the assessment of the product of learning (Chambers and Glassman 1997) and it is here that the assessment of reflective skills plays an important role.

In this context both taught and research, undergraduate and postgraduate programmes in the UK have applied new methods to stimulate and assess the generic competences; in particular there has been a great emphasis on the development of personal and professional skills for professionals.

In 1997 the National Committee of Inquiry in Higher Education (Dearing 1997) recommended that students should have a Progress File which has the potential to embody a holistic concept of learning and lead to the acquisition of both specific and generic competences. It recommended "the introduction of a Progress File designed for people to use throughout their lives" which should include "an official record of achievement and a means by which students could monitor, build and reflect upon their own personal development (Personal Development Planning-PDP)".

The introduction of similar approaches has been a major policy initiative in Higher Education as shown by Strivens (2007) in a survey of e-PDP and e-portfolio practice

in British Higher Education. Almost all Higher Education Institutions (HEIs) claimed that PDP had been implemented in their institution and over three quarters of these were using some form of electronic tool to support it.

1.2 Research questions

The orthodontic specialist programme in Cardiff has been engaged in the process of curriculum revision according to the Outcome-Based Education (OBE) movement. The learning outcomes of the programme were defined in Cardiff and were derived from those identified by the University Teachers Group of the British Orthodontic Society and the SAC in orthodontics (Clark et al. 2004b).

However there were two limitations for effective curriculum revision in the Cardiff postgraduate orthodontic programme:

- the learning outcomes were not “specific” and not very useful to define the assessment system;
- there was a lack of appropriate assessment methods to evaluate the generic learning outcomes introduced in the curriculum.

The curriculum alignment concept and staff members collaboration are two essential factors in order to achieve a curriculum change (Manogue and Brown 2007) and had to be promoted in Cardiff.

The first research question is: Can a consensus on “specific” learning outcomes and assessment methods be achieved among staff members of the orthodontic specialist programme in Cardiff?

The introduction of generic learning outcomes in the curriculum of the orthodontic specialist programme in Cardiff led to the necessity for a tool to stimulate and assess these learning outcomes.

A portfolio with its reflective component, usually called PDP, is an educational tool increasingly required in health education because it promotes holistic learning (Gardner and Aleksejuniene 2008; Snadden and Thomas 1998b). A systematic review of research relating to the process of learning that underlines PDP, conducted

by Gough et al. (2003), showed that PDP supports generic competences and in this way it also leads to improvement of specific competences. Furthermore, a reflective portfolio was used as formative assessment tool for the achievement of the learning outcomes (Challis 2001) and as summative assessment tool for some generic learning outcomes of the curriculum (Gordon 2003; Rees and Sheard 2004a; Rees and Sheard 2004b).

Portfolios have different content and forms according to their purposes. A more flexible electronic format (Gomez 2002) and mobile devices (Centre_for_Excellence_in_Teaching_and_Learning 2005; Garrett and Jackson 2006; Ranson et al. 2007) have been introduced in order to facilitate the achievement of the learning and assessment purposes.

Portfolios and e-portfolios were introduced in nursing, medical education and dentistry leading to some technical difficulties and acceptability issues (Davis et al. 2009; Driessen et al. 2007b; Duque et al. 2006; Gardner and Aleksejuniene 2008; Garrett and Jackson 2006; Kjaer et al. 2006; Pee et al. 2000; Ranson et al. 2007) but there was no evidence of their introduction in orthodontics.

The second research question is: How do the Specialist Registrars (SpRs) and supervisors feel about a reflective e-portfolio instituted in the orthodontic specialist programme in Cardiff?

Personal and professional development learning outcomes were present in the curriculum of the orthodontic training programme in Cardiff and represented the essential professional qualities (professionalism) of a specialist orthodontist. Reflective portfolios were introduced as assessment instruments for reflective abilities (Ker 2002) in the health care professions in order to evaluate professionalism (Friedman Ben-David et al. 2001). However there are still concerns regarding portfolios as assessment tools for reflection and professionalism relating to students' and assessors' acceptance of the process.

Despite there is recognition of reflection as a key factor in health professional education (Davis et al. 2009; Driessen et al. 2005a), there are still some issues regarding the process of reflection assessment, such as: the summative/formative debate, the adequate strategy to provide evidence of reflection, the calibration

process and the assessors' training, the number of assessors (Burnett et al. 2008; Hatton and Smith 1995; Kember et al. 1999; Richardson and Maltby 1995; Sumsion and Fleet 1996; Wong et al. 1995).

The third research question is: What is the SpRs' and mentors' reaction to the introduction of a reflective e-portfolio as a formative and summative assessment tool for reflective abilities, professionalism and learning outcomes in the context of the orthodontic specialist programme in Cardiff?

Chapter 2 Review of the Literature

2.1 Discipline-Based Education

In the past, dental education was mainly disciplined-based. The classical curriculum was organized into disciplines and it was what was taught from the collective knowledge about dentistry and dentally related subjects (Chambers 1993). Students largely learned what teachers chose to teach them and the aim was to produce a dentist with a prescribed package of knowledge upon graduation (Yip and Smales 2000; Yip et al. 2001). Assessment of knowledge was the almost exclusive form of assessment and was obtained by a written examination (Prescott et al. 2002).

Significant problems existed in attempting to structure education around discipline concepts (Chambers 1993) because Discipline-Based Education (DBE) was:

- **Teacher centred**

Learning was considered an activity, and multiple outcomes could be associated with a single curriculum concept (Hunter et al. 1975; Kress et al. 1976). There was confusion over exactly what students should do to demonstrate their mastery of such a concept. While the faculty might agree on the curriculum expressed as the course content, it could at the same time disagree about what was taught or even whether students had learned what was expected (Cook 1989).

- **Historical rather than future oriented**

A curriculum built on disciplines tended to lack progress. Growth areas in dentistry often had no discipline base or they were multidisciplinary (Kress and Vidmar 1985). Because knowledge growth in disciplines was driven by research, a discipline approach to curricula could be expected to emphasize the biomedical sciences and certain clinical procedures. Other forces that drove innovation in the practice of dentistry such as economic, social, legal, and political factors were often lacking in the curriculum (Chambers 1991).

- **Academically neutral**

Discipline knowledge was neutral; it described what “was” based on best sciences, not what “had to be”. Curriculum debates were about what to teach, not what was known. Content organized into disciplines established limits on what could be taught but did not offer guidance about what in the vast collective knowledge base was essential or even the most important to cover (Paverly 1991).

2.2 Competence-Based Education

The problems related to DBE and changes in the educational thoughts of Western countries (Marchese 1994) gave rise to CBE:

- societies became more and more dependent on the expertise of professionals; they wanted or expected more from those professionals. The public wanted more than course-passers from educators; they wanted competent practitioners;
- the same public was reluctant to fund the licensing and certification exams that would have more fully assured the entry into practise of only the truly qualified;
- there were much richer models of professional practice and with those came a keener sense of what it took educationally to bring students to the stages of practising the models determined;
- there was a much richer understanding about learning itself and the undercut inherited academic teaching traditions like story-telling and education as course-taking;
- there was a better knowledge of competency itself.

Extensive changes in professional schools have been necessary in response to these new demands. The changes have had to include not only one but all the aspects of the dental curriculum (Yip and Smales 2000). The adoption of CBE required that the curriculum provided a sequence of defined experiences to students so that, on graduation, they might be considered independent dental practitioners. CBE was based on the early identification of clearly specified learning outcomes that defined

what students are expected to learn. The teaching and assessment systems were modified to allow students to achieve those learning outcomes.

The implementation of a Competence-based system has been a process of evolution rather than revolution in dentistry (Mossey and Stirrups 1997) with some issues related to pre-existing and enduring concerns of the dental organizations, pre-existing beliefs, values, paradigms, ways of being and thinking of the people involved and cost constraints.

There are different models that can be used to facilitate the difficult task of revising the curriculum of a professional programme (Prideaux 2003). The “constructive alignment” concept (Biggs 2002) in curriculum development assumes that there should be a significant relationship between the different components of a programme (Manogue and Brown 2007). This concept was previously used in curriculum design in dentistry (Manogue and Brown 2007) and orthodontics (Chadwick 2004). Collaboration, communication, respect and participative decision making among staff members and students are important factors for a successful process of curriculum changing (Manogue and Brown 2007).

2.2.1 Assessment and the CBE approach

Assessment consists, essentially, of taking a sample of what students do, making inferences and estimating the worth of their actions (Brown et al. 1997).

Assessment is classified as “Formative” and “Summative” on the basis of its purpose (Brown et al. 1997). Formative assessment provides feedback to students, with the aim of improving their learning; and to teachers, with the aim of improving the effectiveness of teaching. It is founded on trust between individuals. Summative assessment is a measure of end-point achievement. Used in this way it provides a mechanism for progression within the course of study, and a summation of learning which can be used to allocate awards or places. Most of the assessment methods can be used in a summative or formative way but it is necessary to specify the assessment purpose clearly.

The utility of an assessment instrument depends on some assessment characteristics (Van der Vleuten 1996):

- reliability is the consistency with which a test measures what it is designed to measure (Cohen and Manion 1989) when used on different occasions, or with different markers, or in different forms. The variability of multiple assessors, the lack of consistency of an individual assessor, complex assessment tasks and the variations between student's performances can lead to low reliability. Specific, manageable and clear criteria or marking scheme, assessors' training, moderators, several assessment instances and different methods of assessment increase reliability (Brown et al. 1997; Manogue et al. 2002);
- validity refers to whether the instrument measures what it is supposed to measure and not something else (Cohen and Manion 1989). In order to be totally valid, of course, a measurement must be highly reliable. Intrinsic validity of an assessment procedure expresses the close match between assessment tasks and to course objectives;
- educational impact expresses the evidence of good influence of assessment on learning;
- acceptability can be expressed by face validity that is the surface impression of and assessment tool (Brown et al. 1997). The purposes of an assessment should be well explained to ensure face validity;
- feasibility depends on the location and environment where the assessment tool is applied (e.g. cost-effectiveness).

The CBE movement raised some issues regarding all the assessment characteristics cited above with the traditional system of professional competence evaluation.

The professional competence evaluation typically covered a narrow range of practice situations (technical skills) and acquired knowledge, and virtually no attention was given to assessment of professional or personal qualities (MgGaghie 1991) although the CBE approach led to the introduction in the curriculum of generic competences that had to be assessed.

The traditional evaluation of professional competence devoted little attention to the direct assessment of practical skills and instead reliance was placed on the indirect assessment of practical skills (MgGaghie 1991). The CBE approach describes

professional competence as fitness for professional practice, it is neither visible nor tangible (MgGaghie 1991) but it is inferred from circumstances that resemble those met in the real world of practice. Its presence or absence are inferred from measurements that are assumed to be good indicators that certain people have or could demonstrate competence under certain circumstances.

A common approach was that of using “performance assessment” as a more valid assessment of CBE. According to Berk (1986) performance assessment was defined as follows:

“Performance assessment is the process of gathering data by systematic observation for making decisions about an individual”.

Stiggins (1987) added that professional performance assessment is a form of evaluation where achievement is measured by means of professional judgement.

However reliability of professional performance assessment could be a problem because it is a form of evaluation where achievement is measured by means of observation (Berk 1986) and professional judgement (Stiggins 1987). Furthermore, there are many variations in effective practice (MgGaghie 1991), and evaluation of the professional competence has to consider and take account of such sources of variation.

Attempts, based on the different concepts of “Competence”, to overcome the dissatisfaction of the evaluation in CBE have been raised in different parts of the world:

- North America
- Australia
- United Kingdom.

2.2.2 Situation in North America

2.2.2.1 The concept of Competency

Chambers and Gerrow (1994) identified five different definitions for the word Competency, and Chambers (1994) declared that the most often used one was: “Competency is the behaviour expected of the beginning independent practitioners. This behaviour incorporates understanding, skills, and values in response to the full range of circumstances encountered in general professional practice. This level of performance requires some degree of speed and accuracy consistent with patient well-being but not performance at the highest level possible. It also requires an awareness of what constitutes acceptable performance under the circumstances and the desire for self-improvement”.

Four characteristics of this definition should be highlighted:

- competencies are what dentists or other oral health care professionals undergo on a regular basis to meet patient’s needs;
- competencies include psychomotor skill performance and the understanding of what is being done, supported by professional values with all three elements expressed in a single statement;
- competencies are performed independently in realistic practice settings;
- performance can be at different levels.

Chambers (1994) affirmed that Competency cannot be understood deeply without understanding it within the context of learning to become a professional. The entire progression of professional learning takes students through the stages from Novice to Beginner, to Competent, to Proficient and finally to Expert. This process is called Competency Continuum (Bruer 1993; Chambers 1994; Chambers and Gerrow 1994). Competency represents the midpoint along the continuum of professional growth (Chambers 1993), where the learner understands the foundations of his/her skills and has internalised appropriate professional values to work independently in normal settings and manages his/her continued growth.

2.2.2.2 The Novice-Expert literature

Chambers (1994) affirmed that becoming a dentist is a long continuum best characterized in terms of the integration of understanding, skills, and values, of internalized control, and of the capability of performing in an increasingly realistic setting. The entire progression of professional learning extends over 10 to 15 years (Chambers and Gerrow, 1994).

Chambers (1998) specified that the process of moving from Novice to Competent is a journey of independence. Initially, students depend on the instructor for structure in learning, performance, and evaluation. It is then necessary to carefully design the experiences students undergo to ensure a rational and nearly complete transfer of responsibility for performance from the faculty to the students. He continued saying that the transition from Competent to Proficient to Expert is a journey of interdependence. It is during this period that the professional absorbs standards of quality and assumes professional identity through the increased relationship with patients and other professionals.

2.2.2.3 Stages in the development of CBE

There were three stages in the evolution of dental CBE in North America.

- First stage-Competency Statements

Chambers (1993) affirmed that Competency was a new way of looking at the dental curriculum. In CBE the dental curriculum had to provide experiences that facilitated the student transition to a realistic practice. This could be realized using competency statements. Chambers (1998) explained that the competency statements should include what dentists practise in their surgeries. The skill in writing competency statements was to be able to change one's perspective from that of the subject matter Expert, who listed what students had to do at school, to a broader perspective of identifying the essential skills, knowledge, and values necessary to practise dentistry. Competency statements formed the bridge between education and practice. The set of competency statements for each school defined the graduates of that school, and

the graduate was expected to possess and to be assessed on each competency statement on the list (quantitative assessment of competencies).

The early attempts to define the competency statement were too specific and idealistic. During the period between 1989 and 1997, there was a clear trend towards a smaller number of competency statements. The experience with competency statements had a shift from statements about specific procedures to statements about meeting patient needs.

In 2001 a holistic concept of Competency called “The general Competency hypothesis” appeared (Chambers 2001). It suggested that dentistry was learned according to a global set of skills, understanding and values that manifested itself in various discipline-specific fashions when the circumstances called for that particular type of performance. It was no longer necessary to measure each specific task in determining Competency, provided that general skills, understanding, and values in related procedures or applications were demonstrated.

- Second stage-Evaluation

The consideration of Competencies in dental education is part of a much broader shift in thinking about the educational process. Hendricson and Kleffner (1998) stated that CBE was a fundamentally different way of educating and evaluating dental students. Considering that Novice, Beginner, Competent, Proficient and Expert individuals learned in different ways (Bruer 1993), Chambers and Glassman (1997) affirmed that they needed different educational experiences, and different types of evaluation.

Instructional strategies

Neidle (1994) suggested that what students do to move on the Chambers’ scale, permits them to become independent learners and to deal with such concepts as lifelong learning and continuing education. These concepts took on a new importance because if, to function successfully, a dentist has to have a solid grounding in Competencies, what he/she learns in a dental school is “the mere tip of an iceberg”.

Teachers were involved in a service intended to empower the receiver (Bruer 1993). Certain instructional methods may help students to acquire the mental process necessary for becoming an independent learner more quickly. Effective techniques, conveying the instructional events that enhanced learning at each phase, have been developed in CBE to move students from the Novice to the Competent level (Chambers 1995; Chambers and Glassman 1997; Hendricson and Kleffner 1998): 1) Performance-based and Problem-based learning by Chambers; 2) The three P's model by Hendricson and Kleffner.

Evaluation strategies

Based on the literature of performance assessment, the best way to evaluate a Novice is different from what is required for evaluating Beginner or Competent student learning (Table 2.1) (Chambers and Glassman 1997). Improvement refers to performance that is more appropriate to the realistic needs of the context, moving from the simulated environment of education to the intrinsically rewarding one of independent patient care.

Dentistry is not characterised by standardized performances and variability is very extensive. Chambers and Glassman (1997) suggested the use of “authentic evaluation” to assess competency in Dentistry based on the fact that “Objectivity is not enough” (Chambers 1975) and that another important component of assessment is Validity. “Authentic evaluation” is the observation of performance or products of performance in contexts that resemble those that would be encountered following the educational programme. However there are obvious disadvantages with “authentic evaluation” in term of fairness, ease of scoring and affinity with measure of reliability that are other important factors in assessment.

Stage of competency	Learning issues	Educational methods	Evaluation methods
<i>Novice</i>	Isolated facts, performance	Lecturing, lab; faculty control	Tests
<i>Beginner</i>	Some synthesis, integration, few choices	Seminars, labs, supervised work	Simulations
<i>Competent</i>	Independence, choice, self-control	Realistic work settings	Authentic evaluation (Portfolios)
<i>Proficient</i>	Identity, professional norms, context	Socialization, specialized training	Work-related markers
<i>Expert</i>	Internalized, patient-centered focus	Self-managed	Self-assessment, internalized standards

Table 2.1: Learning issues, educational methods, and evaluation methods appropriate at various stages on the Competency Continuum (Chambers and Glassman 2007).

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- Third stage-Integrated system

The third phase in which programmes combined written competency statements, teaching and evaluation methods into a complete and integrated system is called the Competency-based system. Glassman and Chambers (1998) considered the application of the Competency-based system at three different levels in the educational enterprise: courses, curriculum and programme.

2.2.3 Australian viewpoint

Biggs (1994) highlighted the importance of both quantitative and qualitative learning and he explained the increase in the structural complexity of learning as it progresses from quantitative to qualitative learning using his SOLO (Structure of the Observed Learning Outcome) taxonomy. The quantitative learning phase is a necessary but not a sufficient condition of what appears to be a minimum level of competence. Competent performance is defined as the qualitative phase.

Biggs (1994) wrote that CBE had a stronger link to the quantitative tradition sacrificing a deeper and more holistic approach. The initial attempt in America to define particular competences, which added up to qualify vocational and professional performance in real life, was a time-wasting exercise.

2.2.3.1 An Integrated approach to Competence

In the 1990's the Integrated concept of Competence appeared in Australia. Hager and Gonczi (1996) defined this new concept of Competence as:

“Competence is conceptualized in terms of knowledge, abilities, skills and attitudes displayed in the context of a carefully chosen set of realistic professional tasks which are of an appropriate level of generality”.

This new concept stresses the attributes possessed by individuals which enable them to satisfactorily work in their life. These attributes are described in terms of knowledge, skills and attitudes. However while attributes are logically necessary for competence, they are not sufficient by themselves. The concept of Competence includes the notion of attributes being applied to the performance of some tasks. Thus the satisfactory account of competence has to include both attributes and tasks and these tasks that are interpreted in a general manner.

- Competency standards

Hager and Gonczi (1993) explained that the Integrated concept of Competence was adopted by the Australian professionals in establishing their competency standards that should include both attributes and tasks. Competency standards could capture a

suitable degree of holism present in professional practice and they allowed for flexibility in work performance because the outcomes achieved were standard but different combinations of attributes could lead to the same outcome (Hager and Gonczi 1993). This was possible because a broad task view was adopted. A feature of the Integrated approach was that it avoided the problem of myriad tasks to be assessed by selecting key tasks or elements that were central to the practice of the profession. Competency standards permitted flexibility in learning, teaching and assessment (Hager 1995) because they described the outcomes without specifying how they were to be learnt, taught and assessed. However competency standards offered powerful guidance in learning, teaching and assessment strategies.

- **Teaching**

Assuming that there was room for improvement in most existing courses, a good set of competency standards would provide invaluable guidance on appropriate methods of delivery (teaching strategies).

- **Assessment**

The Integrated approach to conceptualising Competence was paralleled by an Integrated or Holistic approach to the assessment of competences (Hager 1995). Hager et al. (1994) explained that competence is not something that is directly observed, competence is inferred by performance. The way to proceed is to gather the kind of evidence that would make the inference safe.

The performance criteria were taken as a description of the amount of evidence which needed to be collected to make a safe inference (criteria-performed assessment) (Hager et al. 1994). The criteria were also very important to increase the reliability of competence assessment.

Hager et al. (1994) affirmed that different procedures were employed to assist validity in assessment of competence:

- the forms and methods of assessment selected should be the most direct and relevant to the performance being assessed;

- a mixture of the assessment methods would be recommended to provide adequate evidence (evidence of knowledge, skills and attitudes) on which to infer competence;
- both process-oriented assessment methods and outcome-oriented assessment methods should be employed.

An Integrated assessment should be used wherever possible in order to assess competence in an integrated manner (Hager et al. 1994). It could be performed during training to evaluate the particular stage of development of a student's competence and at the end of a programme to determine something close to occupational competence.

However, competency standards and the Integrated assessment were not immediately relevant in the early stages of a programme. In this period fundamental knowledge and a range of enabling skills, which provided an essential basis for the future development of occupational competences, needed to be acquired and assessed with different methods (Hager et al. 1994).

2.2.4 The situation in the UK

2.2.4.1 The North American and Australian influence

During the 1990's the concept of CBE was introduced in the UK by the influence from North America. A lot of work in developing a Competence-based curriculum was based on a detailed specification of competencies both at an undergraduate and postgraduate level. These competencies were arranged into domains, major competencies, supporting competencies and foundational competencies (Mossey et al. 1997; Prescott et al. 2001).

The competence document was used as a reference point to direct trainers, drive training and act as a comprehensive guide for assessment. It was generally accepted that a holistic system of assessment should be used in order to address all-round Competence (Mossey et al. 1998; Prescott et al. 2002). The requirement for

evaluation in the different domains of competencies (e.g. clinical/communication/knowledge) led to the use of different methods of assessment.

2.2.4.2 Outcome-Based Education

Increasing emphasis has been placed on OBE and on the specification of learning outcomes in the UK.

It was argued that OBE emerged from the objectives movement of the 1950s. Harden (2002a) affirmed that there is a significant difference in how instructional objectives and learning outcomes are interpreted. Learning outcomes are broad statements of what is achieved and assessed at the end of a study programme. Instructional objectives are more specifically detailed statements of educational intentions. Harden (2002a) highlighted five differences between instructional objectives and learning outcomes (Table 2.2).

Area of difference →	The detail of specification	Level of specification where the emphasis is placed	The classification adopted and interrelationships	Intent or observable result	Ownership
Instructional Objectives	Instructional Objectives are extensive and detailed	Instructional Objectives emphasize specification of instructional intent at a lower and more detailed level	Instructional Objectives are classified into discrete areas: knowledge, skills and attitudes	Statements of aims and Instructional Objectives are perceived as intentions	Aims and Objectives are owned by the curriculum developer and reflect a more teacher-centred approach to curriculum
Learning Outcomes	Learning Outcomes can be described under a small number of headings	Learning Outcomes emphasize a broad overview with a design down approach to a more detailed specification	Interrelationship of Learning Outcomes with nesting of Outcomes, knowledge embedded and meta-competences recognized	Learning Outcomes are guaranteed achievements	The development and use of Learning Outcomes can engage teaching staff and reflect a more student-centred approach

Table 2.2: Distinctions between instructional objectives and learning outcomes (Harden, 2002b)

Harden (2002b) defined OBE as an approach to education in which decisions about the curriculum are driven by the outcomes the students should display by the end of the programme. In OBE, product defines process. The educational outcomes are clearly specified and decisions about the curriculum content and how it is organised, the educational strategy, the teaching methods, the assessment procedures and the educational environment are made in the context of the stated learning outcomes. This is done to ensure the students' achievement of the learning outcomes at the end of the programme.

Harden (2002b) drew up a list of advantages in adopting an Outcomes-based model for medical education:

- relevance: OBE helps to focus discussion on the relationship between the curriculum and the practice of medicine, thus the use of OBE can highlight neglected areas such as computer science, health promotion etc.;
- provision of a framework: OBE provides a powerful and robust framework for the curriculum;
- student-centred approach: OBE offers a transparent curriculum with learning outcomes specified to inform both students and teachers about its content;
- self-directed learning: OBE encourages students to take more responsibility for their own learning;
- flexibility: OBE allows the flexibility of teaching, learning and assessment towards the learning outcomes;
- guide for assessment: OBE is consistent with the move to more performance-based assessment;
- participation in curriculum planning: Many individuals or groups can contribute to the specification of outcomes. It encourages and facilitates integrated teaching and learning and the collaboration between disciplines in medicine. It readily embraces the concept of multi-professional education;
- tool for curriculum evaluation: Outcomes provide criteria according to which a curriculum can be judged;
- accountability: OBE, by setting out details of the finished product, emphasises accountability and quality assurance;
- continuity of education: OBE supports the continuity of education by explicitly marking the outcomes of each of the phases or stages of education.

Harden et al. (1999b) described a three circle model to classify the learning outcomes. It is based on the three dimensions of a doctor's job:

- what the doctor is able to do ("doing the right thing");
- how the doctor approaches his/her practise ("doing the thing right");
- the doctor as a professional ("the right person doing it").

Twelve key domains are then identified, each related to one of the three dimensions of a doctor's job. They are intentionally quite broad and lack precise detail. Each domain is then further subdivided into the appropriate learning outcomes. The degree of emphasis placed on each domain and the level of detail required varies between different schools, as the learning and teaching methods depend on the type of curriculum and the resources available. Inevitably some of the domains overlap, with some learning outcomes being common to more than one domain. This illustrates the inextricable links and interdependence between the different elements making up a Competent and reflective doctor (Simpson et al. 2002).

2.2.4.3 Outcome-Based Education in dentistry

Clark et al. (2004b) stated that the three dimensions of a doctor's work were equally applicable to a dentist's work and decided to adapt the three circle model described by Harden et al. (1999b) to dentistry. They affirmed that dentistry is a highly technical profession with the majority of patients encountered requiring some form of interactive treatment, either operative or therapeutic. Therefore they grouped the outcomes to follow the pattern of a patient encountered in the dental setting more naturally. The inter-relationship of learning outcomes, both horizontally and vertically, emphasised the Holistic and Integrated approach to dental education.

The three circle model provided a tool to develop an integrated, transparent, assessment system to assess the complete range of broad outcomes. The assessment was mapped to the range of learning outcomes and their integration and was readily understood by students and staff. Since it was impossible to find a single assessment method that is fully valid, reliable, feasible and appropriate, reflecting real practice, a

range of assessment techniques were required to match learning outcomes being assessed.

The OBE approach has been adopted both at undergraduate and postgraduate level by national dental organisations and local dental institutions in the UK.

The second edition of The First Five Year-A framework for Undergraduate Dental Education was published by the GDC in August 2002 (General_Dental_Council 2002). As with the first edition the overall intention was to define the scope and content of the undergraduate curriculum. However the second edition included, for the first time, a list of specific learning outcomes and an appendix with the learning outcomes in a format described by Harden et al. (1999a).

The Outcomes for Registration-protecting patients, regulating the dental team is a draft document released by the GDC in June 2010 (General_Dental_Council 2010) that describes the outcomes that an individual must be able to demonstrate by the end of their training. These are also the outcomes required for registration as a dental professional with the GDC. The outcomes are grouped in four domains: Clinical, Communication, Professionalism and Management and Leadership.

In November 1995 the Curriculum Working Party of the Specialist Advisory Committee (SAC) produced a curriculum together with Aims, Objectives, Content, Learning Outcomes and Assessments leading to the Membership in Orthodontics of the Royal College of Surgeons (MOrth RCS) for all trainees in orthodontics. The curriculum was set out, in accordance with modern educational practice, in a modular format to assist teaching and assessment. The three circle model for dentistry has been adopted by the University Teachers Group of The British Orthodontic Society and the SAC in Orthodontics to specify the learning outcomes for both Specialists (Table 2.3) and consultants in orthodontics (Clark et al. 2004b). In response to a request from the Specialist Dental Education Board of the General Dental Council in 2008, a new version of the curriculum in orthodontics has been produced (Specialist_Advisory_Committee_in_Orthodontics 2010) to reflect the need for an outcome based curriculum which is indicative of the competencies

required at the varying levels of training within the specialty together with the knowledge, skills and attitudes achieved by the trainee in acquiring those competencies.

A			B				C			
What the specialist is able to do			How the specialist approaches clinical practice				The specialist as a professional			
1	2	3	4	5	6	7	8	9	10	11
Clinical information gathering	Treatment Planning	Treatment procedures	Application of basic clinical sciences	Clinical reasoning and judgment	Communication	Health Promotion	Attitudes, ethical stance and legal responsibilities	Information handling	The role of the dentist within the health service	Personal development
1. Take a history. 2. Undertake an intra and extra-oral examination of the head and neck. 3. Examine the occlusion. 4. Obtain and interpret relevant clinical and laboratory investigation.	1. General principles 2. Craniofacial anomalies. 3. Cleft lip and palate. 4. Integrated restorative care. 5. Integrating oral and maxillofacial surgery. 6. Malocclusion and medical problems.	1. Guiding the developing occlusion. 2. Adult orthodontics. 3. Cranio-mandibular dysfunctions. 4. Interface with oral and maxillofacial surgery. 5. Interface with restorative dentistry including implantology. 6. Interface with paediatric dentistry. 7. Appliances <ul style="list-style-type: none">• removable• functional• extra-oral• fixed• retention	1. General principles 2. Cell and molecular biology 3. Genetics 4. Craniofacial embryology 5. Somatic and craniofacial growth. 6. Physiology of breathing, swallowing, mastication and speech. 7. Psychology 8. Dental materials.	1. General principles 2. Growth and treatment analysis 3. Long term effects of orthodontic treatment. 4. Latrogenic effects of orthodontic treatment. 5. Long term effects of orthodontic treatment.	1. Demonstrate active listening skills. 2. Demonstrate appropriate communication skills with a range of patients. 3. Demonstrate appropriate communication skills (verbal and written) with other professional colleagues. 4. Demonstrate appropriate communication skills with others in the dental team in order to ensure efficient and effective teamwork. 5. Demonstrate appropriate case presentation skills, give appropriate advice and information to promote learning in others.	1. Take into consideration the impact of social, cultural and behavioural factors on dental health. 2. Keep up to date with strategies for prevention of disease in different settings, eg primary prevention, screening, public awareness campaigns. 3. Collaborate with other professionals in health promotion and disease prevention. 4. Apply the knowledge, principles and methods of health promotion so as to include an appropriate health promotion dimension to most clinical contacts.	1. Demonstrate an understanding of patient psychology in relation to health. 2. Demonstrate an ethical and moral approach to patients, their relatives, colleagues and staff, and research undertaken. 3. Demonstrate confidentiality, integrity, truthfulness and respect, without discrimination towards patients and colleagues. 4. Demonstrate an appropriate approach and response to complaints about performance. 5. Recognise and respond to legal responsibilities. 6. Recognise and respond appropriately to colleagues whose professional conduct gives cause for concern.	1. General principles 2. Computer based technology.	1. General. 2. Health and safety. 3. Legislation and ethics. 4. Surgery management. 5. Personnel management. 6. Finance. 7. Audit. 8. Health service structures.	1. Self-awareness. 2. Continuing professional development. 3. Personal growth. 4. Self-care. 5. Career development. 6. Development of additional experience in areas of deficiency or special interest.

Table 2.3: Outcomes grid for the specialist in orthodontics (Clark, 2004b)
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2.2.5 The European approach to Education

In 1999 the European Ministries of Education signed the so-called Bologna Declaration, starting the process to convergence and harmonization of the Higher Educational system in the EU-countries. The objectives of the Bologna Declaration that have been reached within the first decade of the third millennium have been of primary relevance in the establishment of the European Higher Education Area (EHEA). The Bologna Process (Bologna Declaration 1999) is leading to the greater compatibility and comparability of the Higher Education systems in the different countries of the EHEA with the adoption of the European Standards and Guidelines for quality assurance. Moreover, the Bologna Process has promoted the Diploma Supplement and the European Credit Transfer and Accumulation System (ECTS) to further increase transparency and recognition. The EAHE is a key to promote people's mobility and employment and the Continent's overall development.

The objectives set out by the Bologna Declaration and the policies developed in the subsequent years are still valid today. Since not all the objectives have been completely achieved, the Ministers responsible for Higher Education in the 46 countries of the Bologna Process intervened in Leuven/Louvain-la-Neuve, Belgium, on April 28 and 29, 2009. They took stock of the achievements of the Bologna Process and established the priorities for the EHEA for the next decade. They highlighted the importance of lifelong learning, widening access to Higher Education, and mobility in particular.

Two important key aims of the Bologna process are:

- Lifelong Learning

Lifelong learning involves obtaining qualifications, extending knowledge and understanding, gaining new skills and competences or enriching personal growth. Lifelong learning implies that qualification may be obtained through flexible learning paths, including part-time studies, as well as work-based routes. Successful policies for lifelong learning will include basic principles and procedures for recognition of prior learning on the basis of learning outcomes regardless of whether

the knowledge, skills and competences were acquired through formal, non-formal, or informal learning paths.

- **Student-centred learning and the Higher Education teaching mission**

The importance of the teaching mission of Higher Education institutions and the development of learning outcomes has been reasserted. Student-centred learning requires empowering individual learners, new approaches to teaching and learning, effective support and guidance structures and a curriculum focused more clearly on the learner. Curricular reform will thus be an on-going process towards flexible and more individually tailored education paths. Academics, in close cooperation with student and employer representatives, will continue to develop learning outcomes and international reference points for a growing number of subject areas.

2.3 Portfolio

2.3.1 Introduction

Jackson and Ward (2004) argued that the world was becoming increasingly more complex and required more complex models of learning. Gibbons et al. (1994), cited in Jackson and Ward (2004), described a world where people worked with both disciplinary and trans-disciplinary knowledge. He called the knowledge that academic communities helped create and universities and colleges propagated disciplinary. Higher Education curricula were fundamentally concerned with this type of knowledge and assessment processes tested its acquisition and use through a range of traditional assessment methodologies. Trans-disciplinary knowledge was defined as the many other different sorts of knowledge needed by students that are part of the world of professionals.

There was a growing recognition that the models of learning in a traditional disciplinary based Higher Education did not fit well with the world of daily life and work. Jackson and Ward (2004) affirmed that there should be an holistic concept of learning including disciplinary and trans-disciplinary knowledge in Higher Education. They tried to provide a richer construct of the connectivity between the

worlds of education, work and life more generally. According to this new concept of learning new methods to stimulate and assess trans-disciplinary knowledge have been developed and introduced in Higher Education. Portfolios have been introduced as tools to help stimulate and assess trans-disciplinary knowledge.

2.3.2 The history of the Portfolio

Portfolios appeared for the first time in professions such as art, teaching, architecture, design, mass media and journalism particularly in the US and Australia. Such portfolios, being documents of presentation, were generally maintained in order to demonstrate achievement to someone who was in a position to make a judgment of their contents.

The trend towards CBE and the increased emphasis on reflective practice led portfolios to be more widespread in healthcare education such as medicine, nursing and dentistry in the UK (Buckley et al. 2009; Ellis et al. 2006; McCready 2007; McMullan et al. 2003; Tochel et al. 2009). Portfolios have been used for a range of purposes in undergraduate and postgraduate healthcare education in the UK, including supporting reflective practice, facilitating engagement with learning, allowing the continuing of education and delivering formative and summative assessment (Buckley et al. 2009; Gibson 2003; Maidment et al. 2006a, b; Mathers et al. 1999; McCready 2007; McMullan et al. 2003; Tartwijk and Driessen 2009; Tochel et al. 2009).

2.3.3 The definition of the Portfolio

There has been a debate between a generic definition of the term “Portfolio” (Cole 2005a) and a more specific one that included the context-related requirement of reflection in medical education (Rees 2005a). Cole (2005a) argued for a generic definition of the term portfolio, and provided the definition used in the study of Mathers et al (1999) as an example: “a collection of evidence maintained and presented for a specific purpose”. Cole (2005a) continued saying that because

portfolios could differ in their purpose, components and processes, it was not possible to consider one element, such as reflection, as essential.

On the other hand Rees (2005a) explained that a generic definition could be used for an art student's portfolio, but a new definition needed to be considered in medical education. He agreed that portfolios included different types of material depending on their purpose but argued that reflection should be present in all portfolios. Students must be able to reflect on practice and reflective skills which should be developed and assessed through portfolio. Rees (2005b) added that portfolios could be defined as: "a collection of material, made by a professional, that records, and reflects on key events and processes in that professional career" (Hall 1992) and "a purposeful collection of student work that exhibits the student's efforts the collection must include evidence of self-reflection" (Paulson et al. 1991). Both these definitions see self-reflection as the heart of portfolios.

Portfolios have become popular in health profession fields in answer to the demand to have a tool that helped stimulate and assess generic competences. Reflection is at the basis of the development and assessment of most generic competences. Therefore reflection should be considered a fundamental element of all portfolios in the context of health profession fields.

2.3.4 The Portfolio's purpose, content and form

Baume (2003) affirmed that well implemented portfolios are effective and practical in a number of ways including: 1) Repository function; 2) Supporting learning; 3) Personal and Professional development; 4) Assessment.

Whatever the guiding purpose behind a portfolio, it should be clear to the people using it (Challis 1999).

- The portfolio as a repository

Baume (2003) explained that in its simplest, a portfolio is a file containing materials collected by the student in one course or among different courses making up a whole year of study. It can range across the entire programme helping the student to achieve

a valuable programme-wide overview and coherence that sometimes lacking in modular programmes. The repository portfolio is a useful and highly appropriate way of providing a record of achievements (McKimm 2001), such as CV, assignments, training certificates etc.

- The portfolio for learning and development

As a portfolio starts being used as well as simply added to, the word “repository” starts feeling less appropriate and the “development portfolio” gives the feeling of a working document better (Baume 2003). As well as externally-produced items, it includes the student’s work and perhaps also their own and their peers’ reflections on it along with feedback received on their work, and their own reflections on that feedback. The development portfolio illustrates goals, achievement and professional attributes developed over time and not simply the highest level of achievement (McKimm 2001).

- The portfolio for assessment

A portfolio for assessment is likely to include a subset of the repository or development portfolio, together with commentary and reflection, and additional annotation and indexing (Baume 2003). It needs to be tidied up so that the assessor can understand, analyse and assess it rapidly.

Webb et al. (2002) recognised that the form as well as the content of a portfolio depends on the purpose for which it is intended. Because the range of purposes is very large, there is an equally large range of contents and structures of portfolios in use among professions, and even within each profession.

Tartwijk and Driessen (2009) created the triangle in Figure 2.1 to assist in determining whether a portfolio was appropriate for its intended purpose. They defined the nature of a portfolio by positioning the portfolio in the area of the triangle where it was most likely to achieve its intended principal objectives.

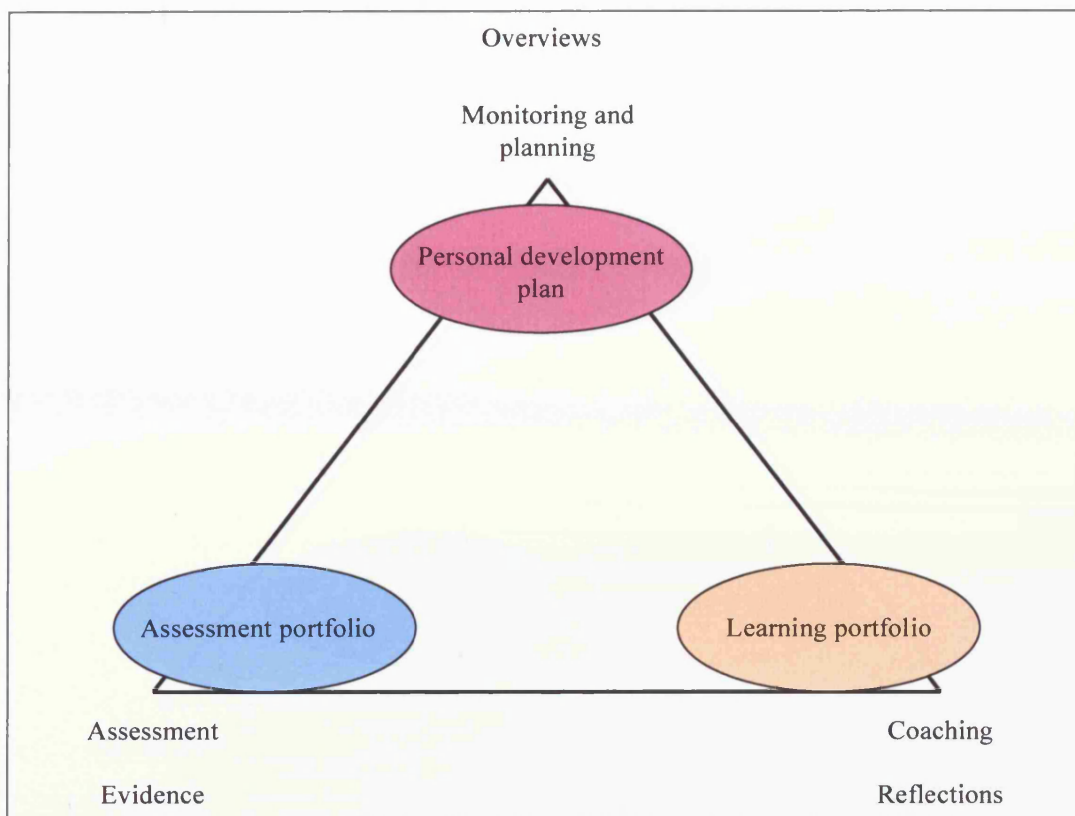


Figure 2.1: The Portfolio's purposes, forms and contents (Tartwijk and Driessen 2009)

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The portfolios with the primary objective to foster learning by stimulating learners to reflect on and discuss their development are organised around the learners' reflections. Portfolios that are primarily geared to assessment remain organised around all kinds of materials that provide "evidence" of competences. In portfolios that are primarily used to monitor and plan learners' development, overviews take the centre stage. When a portfolio moves from the angles of the triangle to the centre, it means that it is used to achieve more than one purpose. This is facilitated if a portfolio has a flexible structure, where clear instructions are important, but learners should have a certain amount of freedom to determine the content of their own portfolios (Driessen et al. 2005a; Driessen et al. 2005b; Snadden and Thomas 1998a). This is in contrast to a previous debate in literature, where the same type of portfolio could not be used for assessment and professional development purposes (Driessen et al. 2007b). The purpose of assessment and learning needs to be clear but can be successfully combined as represented in the triangle in Figure 2.2.

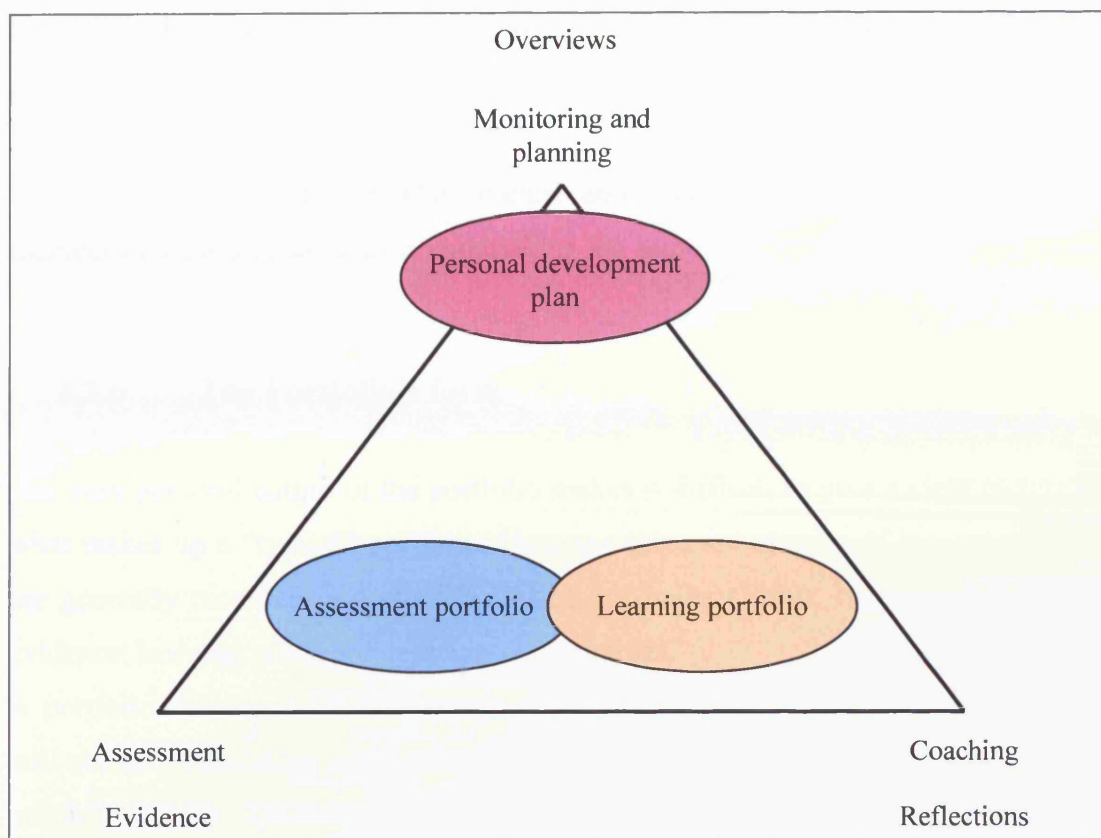


Figure 2.2: Double purposes of a portfolio-Assessment and Learning portfolio (Tartwijk and Driessen 2009)

Reproduced with permission from Blackwell Publishing Ltd. and E.W. Driessen.

2.3.5 The Portfolio's content

The content may be prescribed or left to the students' discretion, but Challis (1999) affirmed that the choice of evidence that is included should rest with the learner and the learner has to take the responsibility for its development, maintenance and presentation for review.

Some evidence is "direct" (Baume 2003) and is created by the learner such as: articles, presentations, description of events and reflections about them. Other items of evidence may be "indirect" (Baume 2003) and are personally relevant to the learner such as: references, certificates, feedback/comments from peers/tutors. The source of evidence is daily practice, or research and development activity necessary to improve practice.

Plagiarism is harder to sustain in a portfolio because it contains more personal and reflective information than a straight essay-style academic text (Baume 2003). Furthermore, plagiarism is more difficult to be present when each student is following his/her own particular interest and trail of enquiry than when every member of a class of students is undertaking the same task.

2.3.6 The Portfolio's form

The very personal nature of the portfolio makes it difficult to give a clear picture of what makes up a “typical” portfolio. However there are a series of key aspects that are generally recorded in a portfolio, cited in Challis (1999): experience, learning, evidence, learning needs and learning opportunities.

A portfolio developed for the purpose of recording a wide range of activity, which will not be reviewed by anyone else, may be relatively unstructured. However, if the portfolio is to be reviewed or assessed, then there are some general guidelines that make it easier for both learner and reviewer to ensure that the portfolio meets its purpose.

A portfolio organised according to learning outcomes might be helpful for assessors, because it indicates what the material in the portfolio is supposed to show, and for learners, because they can organize the evidence in their portfolio in chapters corresponding to the different learning outcomes to be assessed and use captions to explain what the evidence shows about a specific learning outcome (Tartwijk and Driessen 2009).

2.3.7 Technology and Portfolios

As portfolios move from traditional paper-based collections (PBP) to electronic and/or web-based platforms (e-portfolio, WBP), it is important to analyse how the electronic medium supports and influences purposes, contents and forms of portfolios.

2.3.7.1 Paper-based Portfolios

The traditional paper-based portfolio has some disadvantages (Gomez 2002; Tartwijk and Driessen 2009):

- few forms of evidence can be collected;
- it can become bulky with reduced portability;
- generally there is only one copy of the portfolio;
- it is difficult to update.

2.3.7.2 Home-made or commercially available e-Portfolios

An e-portfolio can be created using basic computer skills, by keeping documents and images in a dedicated folder on the hard disk, or using standard generic software. At the other extreme, there are professionally produced web-based e-portfolios which are highly structured and integrated with online databases (Gomez 2002).

The dedicated portfolio systems available, which are usually user-friendly, can provide specific functionalities for specific portfolio goals, such as: work-based assessment instruments, password protected systems and access to the portfolio using the internet. However the dedicated portfolio software is expensive and in many cases the hyperlink functionality of generic software is all that learners need. Furthermore, generic software allows learners to import their own flavour to portfolios enhancing learners' motivation to work with the portfolio. Finally, portfolios built with dedicated software need to be accessible with generic software for maintenance and presentation.

Banister et al. (2006) highlighted the importance of piloting new e-portfolio systems. Their study revealed that an in-house system was better suited to their purpose (teacher education in the USA) than a commercially available one.

2.3.7.3 The flexibility of e-Portfolios

E-portfolios offer the advantage of flexibility in a number of ways (Gomez 2002):

- many media types (audio, video, graphics, and text) are available to collect evidence;
- portability;
- hypertext links organize the material, connecting evidence to appropriate outcomes (Barrett 2007);
- sharing and exchange of information that would not be possible in paper format;
- easily kept up to date (Tartwijk and Driessen 2009);
- relatively easily restricted access to material (e.g. password protected files, login) (Gomez 2002).

Some articles appear to warrant a conclusion in favour of WBP against PBP. Driessen et al. (2007a) conducted a one year randomised trial of two types of portfolio format (WBP and PBP) with first year medical students in Maastricht. Five of the 17 mentors were randomly selected to participate and the two groups of students were randomly allocated to either paper (n=47) or web (n=45) based portfolios. Although the comparativeness of the groups was not described, it is assumed that the unspecified randomisation procedure adequately minimised bias. Pairs of raters independently scored the portfolio content for quality of evidence and reflection. In the web-based group learners added more personal touches to content and form and invested more time in their portfolios. Mentors, in an interview, were unanimous in their appreciation of the greater ease in the use of web-based portfolios compared to the more familiar paper-based ones. Weaknesses in this study are that it does not include the trainees' perspective on the WBO/PBP portfolio comparison and it does not prove that the additional time learners spent with the portfolio provided a benefit.

Kjaer et al. (2006) developed and validated two questionnaires (one for users and one for non-users) to evaluate a new online portfolio by postgraduate medical trainees. After using the e-portfolio for 7 months, 87% of the users agreed that they preferred

the electronic medium to pen and paper and almost all agreed that they would continue using the portfolio in the future. However users and not users highlighted some technical difficulties in using the e-portfolio and added that dedicated time and a proper induction were needed. Weaknesses of the study are that it enrolled first users of e-portfolio, whose reactions could differ from the steady-state situation, and did not include the trainers.

2.3.7.4 The impact of e-Portfolios on learning and assessment

The flexibility of e-portfolios gives the benefits of being better able to match pedagogic and curricular requirements and of leading to the possible improvement of portfolio impact on learning.

Barrett (2007) explained that an e-portfolio could balance the need of the institution for an assessment management system with the need of learners for a reflective portfolio that supported deep learning. She described an e-portfolio framework with three different elements:

- a digital archive of learners' work;
- a learner-centred electronic portfolio;
- an institution-centred database or assessment management system.

Chang (2001) officially implemented a web-based learning portfolio (WBLP) in a course of the Teacher Preparation Programme for approximately half a semester. Making use of the web-based portfolio as a self-assessment tool, this study evaluated the impact of WBLP on the students learning process. The evaluation included a pilot-tested questionnaire for users (35) and an interview for experts (3). The results of the integration of portfolio rationales and internet technology showed that most students considered the system to be helpful in improving the interaction between students and with teachers, in understanding the authentic learning process and outcome and enhancing the learning process. Weaknesses of this study are that it was conducted over a short period and the subjects were students in the "Computer and Instruction" course.

2.3.7.5 The disadvantages of e-Portfolios

There are also disadvantages associated to e-portfolios (Tartwijk and Driessen 2009):

- an e-portfolio requires a stable and high quality information technology infrastructure that is not always available;
- e-portfolios can only be used by learners and teachers who are sufficiently skilled in using the relevant software and hardware.

Hauge (2006) showed evidence that users' technical ability and knowledge significantly affected how they interacted with the e-portfolio.

Training is likely to be a requirement when implementing an e-portfolio system. Duque et al. (2006) evaluated the influence of training and support in a one year study of 133 medical trainees in a one month geriatric rotation (11 students per month), though they did not measure the training's influence directly on the usage. The study evaluated the students' use of an e-portfolio randomly divided into control (no training) and intervention (introductory hands-on session) groups, surveying both students and tutors. Students' marks in their portfolios were also compared between both groups. The introductory session had a significant effect on students' portfolio marks as well as on their comfort using the system.

Whilst the electronic medium requires support and training especially for those less familiar with technology, the students in the study of Kjaer et al. (2006) affirmed that the time spent with the trainer should be used to discuss educational issues and not technical issues. Furthermore in the study of Kjaer et al. (2006), trainees noted that the hospital setting might make the use of an e-portfolio problematic (with access to computers) unless a Personal Digital Assistant (PDA) version was available.

2.3.7.6 The Personal Digital Assistant

PDA is a generic term for a variety of portable hand-held electronic devices, which share many of the functions of desktop computers (Hirani et al. 2005).

Lindquist et al.'s (2008) review had the aim of obtaining an overview of existing research on the use of PDAs among personnel and students in health care. The literature search included original peer-reviewed research articles written in English and published from 1996 to 2008. From the 900 references initially screened 48 articles remained. They conducted a content analysis, using Nielsen's Model of System Acceptability as a theoretical framework in structuring and presenting the results. These showed a positive attitude towards the PDA, it was often viewed as the preferred tool when compared to paper-based documents and was regarded as a feasible and convenient tool. The possibility of immediate access to medical information has the potential to improve patient care by means of the improvement in decision-making, the reduction of the numbers of medical errors, and the enhancement of learning for both students and professionals. There was some evidence that the use of a PDA in health care settings might increase, but the evidence was not strong, with most studies being descriptive, and only 6 randomized controlled trials. The review concluded that other intervention studies, RCTs, and action research studies with various health care groups were needed to determine the PDA's appropriate functions, PDA's software application, and context and cost implications.

Several special software programmes have been created and tested for PDAs, and a wide range of situations for their use have been reported for different students groups.

In the qualitative study of Ranson et al. (2007) a purposive sample of 10 practising physicians used a PDA version of the Virginia Board of Medicine Continuing Competency and Assessment Form (CCAF) for six months after 1.5 - 4 hours of training with the mobile device. It was a learning portfolio intended to encourage documentation of reflection on practice. Three sources of data were analysed: a questionnaire describing PDA usage, transcripts from telephone interviews, and CCAF written reflective comments. Although there were apparent barriers to using the PDA in a clinical environment (e.g. loss, limited memory, interface limitations and students' IT skills), findings indicated that the PDA was useful for:

- providing information for making clinical decisions (e.g. drug software);

- providing information for patient education and for teaching medical students;
- prompting physicians to reflect on changes in clinical practice.

However the reduction of text required to record reflection and the application of other technological platforms (e.g. Web-based) might provide greater functionality and ease of use for physicians.

Garrett and Jackson's (2006) study outlined the development and evaluation of a PDA based clinical portfolio designed to promote professional reflection, to support and improve clinical learning and to help prevent the isolation of students whilst engaged in supervised clinical practice. The combination of wireless and internet technologies allowed more complex tasks, including access to email and to special PDA formatted Web channels, browsing Web sites and the ability to synchronize data between the PDA and a computer via the internet. The pilot study involved nursing and medical students for three months, during the academic year 2005-2006. Students' perceptions on the potential uses of the e-portfolio and clinical PDA based tools were collected by means of a questionnaire and a focus group interview. The data content analysis performed has not been explained in detail reducing the rigour of the study. Students revealed positive attitudes to the use of PDA based tools and portfolio, but the findings indicated a consistent view of the PDA as a reference tool rather than a multimedia communications medium. These limits to the use of the PDA portfolio were due to the inherent interface restrictions of the PDA for portfolio application and for communication.

PDAs have been involved in one of the projects of the "Assessment and Learning in Practice Settings" (ALPS) initiative (Centre_for_Excellence_in_Teaching_and_Learning 2005). ALPS is a collaboration of five Higher Education Institutions (HEI) (University of Bradford, University of Huddersfield, University of Leeds, Leeds Metropolitan University and York St John College) working with 16 health and social care professions, including dentistry, and a wide range of partners, including the West Yorkshire Workforce Development Confederation, clinical networks and professional bodies, to increase the professional

competence of graduating health and social care students. The plan is to achieve this by extending excellence and innovation in assessing practice, helping students learn both within their professions and across professional boundaries and raising the status of teaching in practice.

Part of the ALPS programme of work is the delivery of e-learning tools to mobile devices via a shared Mobile Services Platform (ALPS Assessment Suite), a unique IT (Information Technology) solution with a central service that tied into the authentication, student data and virtual learning systems of each of the five partner HEIs. It is a complex e-learning package including inter-professional assessment tools alongside the students' use of the devices for immediate reflective learning through audio, visual and text capture. All content is encrypted and securely uploaded via the Mobile Services Platform to an e-portfolio, anytime, anywhere. The students' work is then assessed and a process of feedback, discussion and work planning can begin between student and tutor.

2.3.8 The development and introduction of Portfolios

There are different factors that should be considered before starting a portfolio practice and that influence its success:

- time;
- people;
- mentor-learner relationship;
- portfolio guidelines;
- qualitative data for the interpretation of portfolio assessment;
- academic leadership;
- infrastructure.

2.3.8.1 Time and people

Time and people, involving both teachers and learners, are identified as key factors for lasting portfolio experiences (Tartwijk and Driessen 2009).

In most cases, teachers are expected to invest more time and effort in coaching and assessment than they were used to. Almost inevitably, this change in roles and routines causes uncertainty and evokes resistance.

The successful introduction of a portfolio in education also depends on how much time and energy learners are willing to invest in their portfolios. Self-assessment, asking for feedback, reflection and identifying personal learning needs, which are fundamental to portfolio learning (Tartwijk and Driessen 2009), are perceived as strange and sometimes even threatening by learners for whom education is synonymous with lectures and exams.

2.3.8.2 The mentor-learner relationship

It is difficult to define mentoring as it has different manifestations. A definition for postgraduate dental education is cited in Spicer (2004): “a complex interactive process which incorporates interpersonal and psychological development, career and/or educational development”.

Mentorship appears to be crucial for successful portfolio use (Driessen et al. 2005a; Mathers et al. 1999; Snadden and Thomas 1998b; Snadden et al. 1996). The nature of the mentor support varies according to the needs of the learner and the purpose of the portfolio (Driessen et al. 2007b). Most learners approaching portfolio development for the first time require some support, not only in the actual construction of the portfolio, but also in the unfamiliar process of engaging in recording reflections about their work. Support is particularly important for those whose portfolios are externally reviewed or assessed.

Support may be offered in many ways within a common working environment and may take any or all of the following forms (Challis 1999):

Timetabled mentoring. Where time slots are agreed for meetings and outcomes are identified and discussed.

Corridor meetings. Where more informal support is offered under circumstances where mentor and mentee meet anyway.

Mutual mentoring. Where self-help pairs or small groups meet to support each other or work as study groups.

Telephone mentoring. This is particularly appropriate where mentors and mentees work at some distance from each other.

Co-mentoring. Students act as mentor of one another.

A problem that is much debated in the portfolio literature is the feasibility and acceptability of combining the roles of mentor and assessor into one person. On one hand it is agreed that mentors are the people who are best informed about the learners' competences. As a consequence, ignoring the mentors' opinion in assessing portfolios can be considered as losing the opportunity to improve the validity of the assessment (Tartwijk and Driessen 2009). On the other hand, combining the roles of assessor and mentor can put a strain on the relationship between mentors and learners. Learners may be reluctant to discuss any difficulties they are facing for fear of repercussions in the assessment. Striking the right balance between support and judgement is the challenge facing assessors/mentors with whom learners talk about their portfolios (Tartwijk and Driessen 2009).

2.3.8.3 The Portfolio guidelines

McMullan et al. (2003) concluded in a study in nursing that portfolios could be very effective only if both students and mentors received clear guidelines for their use. They noted that, without clear guidelines, students and mentors became increasingly stressed and demoralised about the use of portfolios in practice.

Guidelines help give users a feeling of control and confidence at the start of using a new system and are essential in allowing their openness to development (O'Sullivan et al. 2004; Snadden and Thomas 1998a).

Guidelines may be given to users through workshops and by providing written guidance notes. Bringing groups of learners and teachers together to explore ideas through discussion and challenge is fundamental in dealing with some barriers (Snadden and Thomas 1998a).

2.3.9 The advantages and disadvantages of the Portfolio

The use of portfolios as a record for the purposes of learning and assessment has grown enormously from its initial stage. However the present day evidence suggests that the introduction of portfolios for these purposes has been met with mixed success (Buckley et al. 2009; Driessen et al. 2007b; Tochel et al. 2009). This can be explained by the fact that the Portfolio has a number of advantages as well as disadvantages.

The advantages include (Challis 1999; McKimm 2001):

- it recognizes and encourages the autonomous and reflective learning that is an integral part of professional education and development;
- it is based on the real experience of the learner, and so enables the consolidation of the connection between theory and practice;
- it can accommodate the evidence of learning from a range of different contexts;
- it allows a range of learning styles to be used according to the preferences of the learner;
- it enables assessment within a framework of transparent and declared criteria and learning outcomes;
- it provides a model for lifelong learning and continuous professional development.

The disadvantages to be considered are (McKimm 2001):

- it is a time consuming process for learners and teachers;
- learners and teachers often do not see the relevance in reflective learning;
- care must be taken in clearly defining its purposes;
- mentors/facilitators/tutors must be trained;
- although the portfolio's important role in formative assessment is often stressed, the way developmental feedback is delivered by assessors and how it becomes accepted still remains a stumbling block;
- if used in summative assessment then issues of acceptability, reliability and validity have to be addressed;

- the use of criteria in appraising or grading the evidence being collected is often not well integrated nor related to the competences specified in the curriculum (Smith and Tillema 2003).

2.4 The Portfolio for Learning and Development

Professional education should prepare competent professionals who can practise in the real world in the best interest of patients. In order to achieve this aim professional education has to encourage Holistic learning by favouring the concepts of student-centred curriculum and lifelong learning.

Educationalists such as Boud and Walker (1993) suggested that educational programmes should not be passive but interactive and related to experience. By including these components learners are given more autonomy and are encouraged to take charge of their own learning (adult and self-directed learning) (Snadden and Thomas 1998a).

Snadden and Thomas (1998b) introduced the term “portfolio learning” as a method of encouraging adult and self-directed learning for professionals. They emphasised the importance of good feedback and critical reflection for portfolio learning in a two year qualitative study of portfolio use among 44 vocational training registrars and 27 trainers.

Gardner and Aleksejuniene (2008) conducted a one year pilot study at the University of British Columbia to explore the usefulness of e-portfolios as a learning tool for 16 dental students who chose to use reflection (sixteen of the forty-eight students of the operative dentistry clinical simulation module). Once the school year was over, a survey was designed to conduct qualitative and quantitative analyses of the e-portfolio’s effectiveness as a learning tool both based on the self-reports. Qualitative assessment included student self-reflection on the e-portfolio experience. In the quantitative evaluation, e-portfolio learning was hypothesized as a multidimensional experience with four dimensions: two dimensions related to the learning experience and the other two dimensions were related to time management and technical

aspects. Both qualitative and quantitative evaluations showed that the majority of students had a positive experience with the e-portfolio. They felt it helped them grow professionally as well as integrating scientific understanding into their clinical performance of operative dentistry. Some students were concerned about technical difficulties and time management related to e-portfolio learning.

However it is crucial to remember that the e-portfolio assignment was presented as an option for those students who liked to reflect on their work and that the sample size was relatively small, thus the findings should not be generalized.

2.4.1 The Personal Development Planning

One of the components of the portfolio that promotes reflection is the PDP (Baume 2003). The PDP is defined as “a structured and supported process undertaken by an individual to reflect upon their own learning, performance and/or achievement and to plan for their personal, educational and career development” (Quality_Assurance_Agency 2001). When an educational task, proposed in the PDP, has been completed and documented in a portfolio, the learner can use the portfolio to reflect on the task and update his/her PDP.

The PDP process can be explained in a way that emphasises learning by reflection (Jackson 2001). It is represented by a circle with the core questions that underpin reflective learning and planning for self-improvement (Figure 2.3).

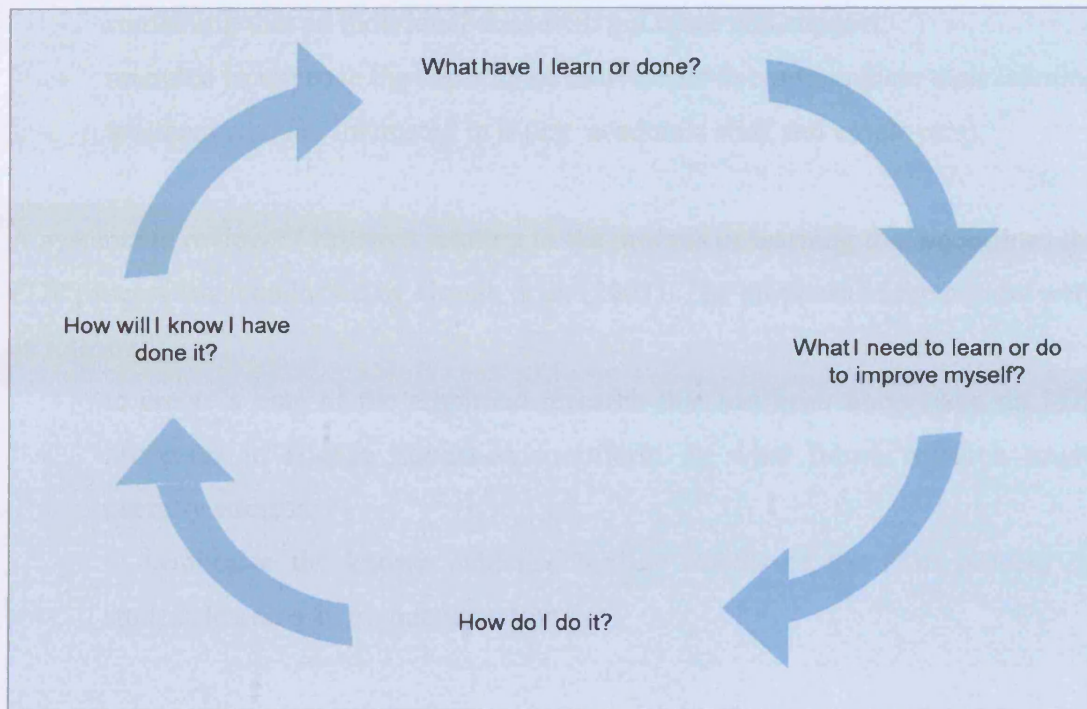


Figure 2.3: The PDP process (Hinett, 2002)

The PDP process provides a structure for learning, personal and professional development. It is intended to help students (Quality_Assurance_Agency 2001):

- articulate and reflect on what they are doing;
- understand how they are learning and relate their learning to a wider context;
- enhance self-awareness of strengths and weaknesses and directions for change;
- articulate their personal goals and evaluate progress towards their achievement;
- identify ways of improving themselves and their work and work towards the objectives and directions they set for themselves;
- become more effective, independent and confident self-directed learners;
- encourage a positive attitude to learning throughout life.

These constructs support the idea that the PDP is (Quality_Assurance_Agency 2001):

- an integrated and strategic process that is integral to higher level learning;
- concerned with learning in an holistic sense (both academic and non-academic);

- something that an individual does with guidance and support;
- intended to improve the capacity of individuals to communicate their learning to others who are interested in it (e.g. academic staff and employers).

A systematic review of research relating to the process of learning that underlines the PDP process was conducted by Gough et al. (2003). The purposes of the review were as follows:

- to create a map of the empirical research that has been undertaken on PDP processes in Higher Education to inform on what future research might usefully address;
- to synthesize the known evidence for the effects of the PDP process on student learning in higher education.

The systematic review developed a search strategy and detailed inclusion and exclusion criteria to identify the English language empirical literature on PDP-type (learning logs and journals, diaries and studies of reflective practice) processes; it involved the screening of over 14,000 references.

The map on PDP literature showed that there was still little coherence in terms used for PDP and reflection. Many studies, examining the effects of the PDP, focused on the participants' views that were only one aspect of studying the effects of a learning approach. There was also a lack of balance, at least in the UK, between descriptive and experimental research testing the effects of the introduction of the PDP process. Finally the map revealed that some aspects of the PDP learning (e.g. reflection, use of learning logs and journals, self-assessment and self-regulation) have been studied more than others (e.g. action planning, use of portfolios, self-awareness and self-motivation).

The review proposed the question: "What evidence is there that the PDP process improves students learning?" The choice of papers was based on studies involving "researcher-manipulated interventions" and "independent outcome measures". The synthesis led to the production of a short list of 25 studies. Most of these studies reported a positive effect of the PDP process on learning. The PDP could have a

positive effect on student attainment and on the students' approach to learning. Gough et.al (2003) concluded that it was not possible to know "how or why" the PDP process was producing the effects reported. There was insufficient evidence to state which balance of the many PDP approaches was more or less effective in impacting on student learning. Neither was there evidence to comment on the influence of the individual teacher in promoting and facilitating learning through the PDP process.

Clegg (2004) criticized that, despite the procedural rigour, the review of Gough et al. (2003) said very little that was useful in the UK practice. Most of the 25 studies in the in-depth review originated in the US, with only one originated from the UK. They involved most self-regulation and less independent learning, logs and journals that have been core features of the UK practice. Furthermore, as the final list of studies were not related to one another in any systematic way, it was not known whether the reported outcomes were produced by the same or different mechanisms and if, given the cultural variation, the term reflection was used with any consistency.

Jackson (2001) affirmed that, depending on the context, the PDP might be assessed or not assessed. Assessment might signify institutional valuing of the PDP, however there were significant issues concerning assessment of the learning that was highlighted by the PDP (Ward and Baume 2002):

- what should be assessed (evidence, critical reflection or both)?
- what outcomes might be appropriate?
- what assessment criteria should be used?
- assessment might not sit easily with a personally-referenced PDP that emphasised student ownership, and indeed might militate against openness and honesty.

2.4.2 Reflection

Reflection is an essential component of the PDP process in a portfolio and allows the portfolio to be used as a learning tool.

Different definitions and models of reflection have been developed during the years following a process of evolution of the relationship between reflection, deep learning and professional development.

2.4.2.1 Dewey's (1933) model of reflection

Dewey (1933) considered reflection as a mental process characterized by different steps and defined it in this way:

“Active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and further conclusions to which it leads...it includes a conscious and voluntary effort to establish belief upon a firm basis of evidence and rationality”.

In every case of reflective activity, a person finds himself/herself confronted with a given, present situation from which he/she has to arrive at some new learning.

In relation to reflection, a number of processes can occur at once (Dewey 1933); some stages can be skipped because it is not necessary to go through the series of set stages in order to learn.

2.4.2.2 Kolb's (1984) experiential learning cycle

The important role of reflection in the context of holistic learning started to appear with Kolb's (1984) model of reflection.

Kolb (1984), on the basis of Dewey's (1933) work, considered reflection as a mental activity that has a role in learning from experience. Kolb (1984) created a four-stage model on how experience is transformed into learning and represented it in the famous Kolb's cycle or experiential learning cycle (Figure 2.4).

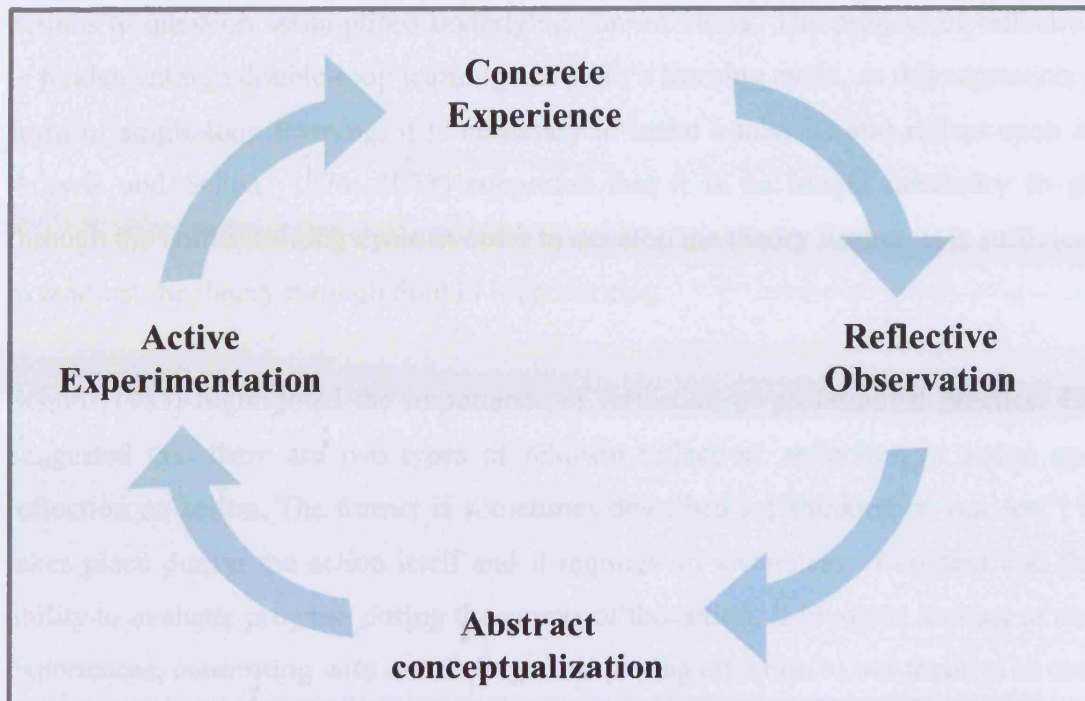


Figure 2.4: Kolb's (1984) experiential learning cycle

Kolb (1984) over simplified what is an immensely complex activity. In Kolb's cycle, the idea of stages is rather too neat and simplistic in relation to that proposed by Dewey (1933). Reflection features as development of the process of observation and it apparently occurs before a person has learnt.

2.4.2.3 Schön's (1983) theory of reflection

Schön (1983) made a remarkable contribution to reduce the gap between the world of education and everyday life in order to obtain holistic learning. The theory learnt in formal institutions and in professional training (Espoused theory) is not the one used by proficient professionals to guide practice. They build up a theory, called "Theory in use", from their practice by being reflective. The "Theory-in-practice" (Argyris and Schön 1974) concept proposed that a gap exists between what individuals say they want to do (Espoused theory) and what they actually do (Theory in use). In order to effectively come to grips with new situations, the espoused theories need to be aligned with the theories in use. Double-loop learning techniques (Argyris and Schön 1978) help to obtain this. Double loop learning uses feedback from past

actions to question assumptions underlying current views. The process of reflection is fundamental in double-loop learning. In Kolb's learning cycle, as this represents a form of single-loop learning, it is necessary to make a mistake and reflect upon it. Argyris and Schön (1974; 1978) supported that it is no longer necessary to go through the entire learning cycle in order to develop the theory further. It is sufficient to readjust the theory through double-loop learning.

Schön (1983) highlighted the importance of reflection in professional practice. He suggested that there are two types of relevant reflection: reflection in action and reflection on action. The former is sometimes described as "thinking on our feet", it takes place during the action itself and it requires an awareness of context and the ability to evaluate progress during the course of the action. It involves looking at our experiences, connecting with our feelings, and paying attention to our theories in use. It entails building a new understanding to inform our actions in the situation that is unfolding. It appears to be the most complex and demanding kind of reflection and such an approach to reflection develops only as a consequence of considerable experience. Observation of behaviour followed by conversation is important to analyse reflection-in-action (Schön 1983); it is the major way in which theories-in-use can be recognized. Reflection-on-action comes later. Professionals may reflect by writing up recordings, discussing with a mentor and so on. The act of reflecting-on-action allows time to be spent exploring what happened, how and why, and lead to the development of principles that can be used in "reflection-in action".

2.4.2.4 The reflection model of Boud et al. (1985)

Boud et al. (1985) continued to highlight the important role of reflection in professional development but particularly regarding reflection-on-action.

The initial experience includes aspects of behaviour, ideas and feelings. These then feed into the reflective processes, which involve returning to the experience, attending to feelings in relation to the retrospective perception of the experience and re-evaluating the experience. The outcomes of these processes then result in new perspectives on experience.

The model has subsequently been extended into a model for facilitating learning from experience (Boud and Walker 1990, 1993). The essence of this model is that learning from experience can be enhanced through both reflection-in-action and reflection-on-action. All learning builds on existing perceptions and frameworks of understanding; therefore, links must be made between what is new and what already exists if learners are to make sense of what is happening to them. Learners bring their personal foundation of experience to any event. Past experiences profoundly affect the perception of what does and does not count as important; they act as a way of sensitizing learners to some features of their world and blind learners to others, and they shape the intention learners have that determines their priorities.

Additionally, reflection needs to be flexibly deployed (Boud and Walker 1998) - it is related to the need and intention of the learner and is highly context-specific. The social, cultural and political context in which reflection takes place has a powerful influence over what kinds of reflection it is possible to foster and the ways in which this might be done. Boud and Walker (1998) talked about the development of a “local context” where one operates in conditions under which reflection might be promoted.

2.4.2.5 Gibbs’ (1998) cycle of reflection.

Gibbs (1998) proposed a model of reflection taking emotions into account (Boud et al. 1985) and he described it as “The reflective cycle” (Figure 2.5). This model of reflection entails six steps that described in an easy and complete way the process of reflection-on-action. Each step has some characteristic questions that can help students in the reflective process.

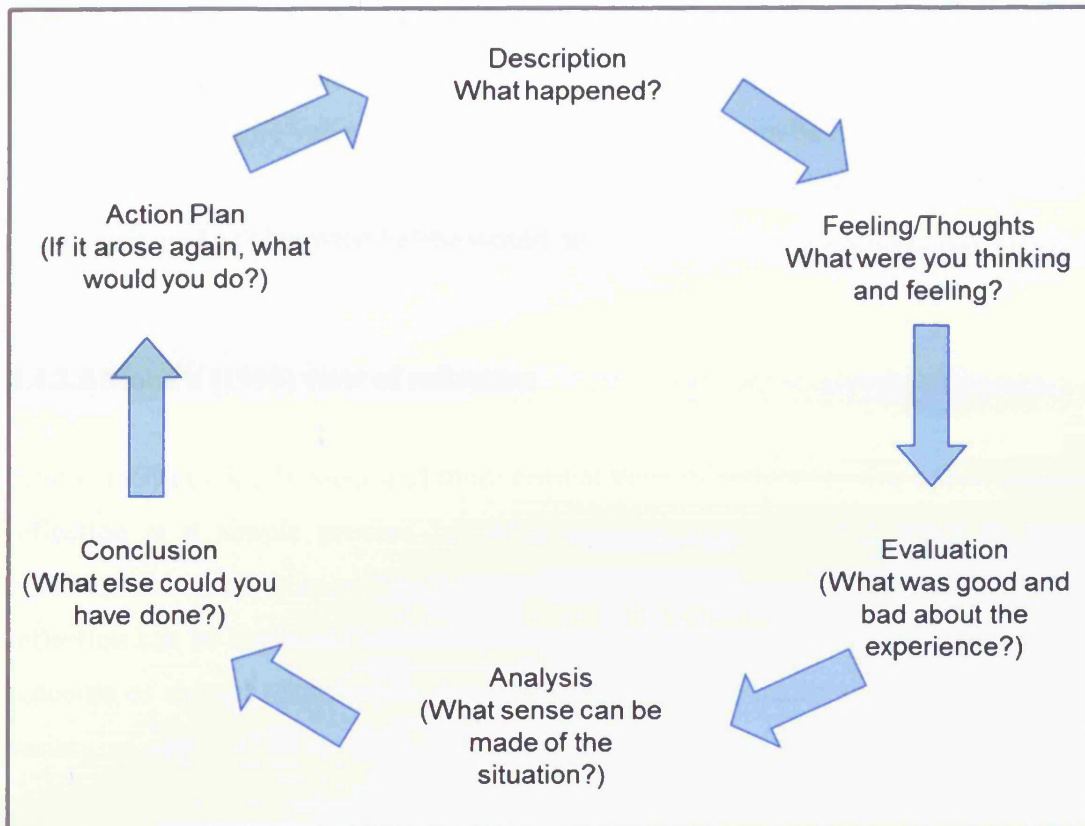


Figure 2.5: Gibbs' (1998) cycle of reflection

The six stages of the reflective model are described by Gibbs (1998) as follows:

Description of the event. A detailed description of the event the reflector is reflecting on.

Feelings. The second stage is a discussion about thoughts and feelings of the reflector about the event. At this stage the reflector should try to recall and explore the things that were going on inside his/her head during the event.

Evaluation. The reflector should try to evaluate or make a judgement about what has happened. He/she should consider what was good about the experience and what was bad about the experience or didn't go so well.

Analysis. In the fourth stage the reflector should make sense of the situation. He/she should break the event down into its component parts so that they can be explored separately.

Conclusion. The reflector should explore the issue from different angles and obtain a lot of information to base his/her judgement on. It is here that the reflector is likely to develop insight into his/her own and other people's behaviour in terms of how they contributed to the outcome of the event. The purpose of reflection is to learn from an

experience. Without detailed analysis and honest exploration that occurs during all the previous stages, it is unlikely that all aspects of the event can be taken into account and therefore valuable opportunities for learning can be missed.

Action Plan. During this stage the reflector should think ahead into encountering the event again and to plan what he/she would do.

2.4.2.6 Moon's (1999) view of reflection

Moon (1999) took a broader and more critical view of reflection. She explained that reflection is a simple process but with complex outcomes that relate to many different areas of human functioning. The different theoretical approaches to reflection can be explained by the fact that most writers are more concerned with the outcome of the act of reflection than with the process. Finally she summarized the variety of approaches to reflection in the literature in a relatively simple input-outcome model of reflection (Moon 2001) that represents the basis for the consideration of reflection in the PDP.

Moon (1999) described reflection as: “a form of mental processing that we may use to fulfil a purpose or to achieve some anticipated outcomes, or we may simply be reflective when an outcome may be unexpected. Reflection is applied to relatively complicated, ill-structured ideas for which there is not an obvious solution and is largely based on the further processing of knowledge and understanding that we already possess”. This definition underlined that reflection is part of learning and part of the meta-cognitive process of material already learned, generating new learning.

2.4.3 Reflection and Learning

In the input-outcome model of reflection (Moon 2001) all the outcomes represent the relationship between reflection and learning showing how the reflective activity supports the process of good learning (Moon 2007), adult learning and personal development. Some evidence of the possibility of reflection to support determined outcomes is present in the literature and cited below.

- Deep learning, knowledge and understanding (Moon 2001)

Moon (2001) explained that surface and deep learning represent the extremes of a continuum and she created a hierarchy of stages of learning along the continuum:

Noticing. Memorized representation.

Making sense. Reproduction of ideas, ideas not well linked.

Making meaning. Meaningful, well integrated, ideas linked.

Working with meaning. Meaningful, reflective, well-structured.

Transformative learning. Meaningful, reflective, re-structured by learner, idiosyncratic or creative.

This model of learning is a useful device to highlight that reflection has a role in the deeper approaches to learning (the last three stages described above) but not in surface approaches to learning (the first two stages).

- A process of critical thinking (Boyd 2002; Hinett 2002a)

Boyd (2002), in her pilot study, explored how written and verbal reflection on clinical experiences over two terms might facilitate the development of critical thinking in a convenience sample of sixty-nine first year dental students as well as assist them in integrating their didactic coursework with clinical care. A thematic analysis was carried out of the data collected through semi-structured interviews, clinical observations, and written reflection papers by dental students. The analysis underlines a process that began with students questioning assumptions about their prior experience and knowledge and that led them to look at things in a new way and ultimately to recognize the need to take some action to provide care to the patient.

The results of this paper also highlighted the necessity of changes of teaching and assessment processes in dental education: reflection should be inserted early in the curriculum to promote critical thinking before students start clinical practice.

- Development of a theory, making a decision or resolution of some uncertainty, the formulation of a plan of action (Hinett 2002b; King 2002)

King (2002) expressed the view that a variety of outcomes (e.g., development of a theory, the formulation of a plan of action, or a decision or resolution of some uncertainty) can be expected when students use reflection.

Hinett (2002a) in her article “Improving learning through reflection” explained that reflective practice can be seen as both a structure to aid critical thinking and improve existing understanding and a method for promoting autonomous and deep learning through enquiry. She added that reflection helps to clarify and make sense of what has been learned and to locate it within an individual framework, enabling students to identify patterns, resolve uncertainties and make decisions for tackling new situations in the future.

- Learning from experience and reducing the theory-practice gap (Grant et al. 2006)

Grant et al. (2006) explored the perceptions of 20 year three medical students who voluntarily kept a learning journal for two terms and attended fortnightly facilitated tutorial group to discuss their reflection. In subsequent groups’ interviews, these students reported that they felt better able to identify their learning need and were better able to integrate learning from different sources, particularly integrating theory with practice. No differences were found in the exam results of these students compared with those who had not kept the journal, but it can be justified by the fact that the sample was small and that the students used reflective journal for a short time.

- The improvement of learners’ cognitive ability and the encouragement of meta-cognition (Moon 2001), the development of personal and professional skills (Hinett 2002a; Mathers et al. 1999; Wald et al. 2009; Wessel and Larin 2006)

Hinett (2002a) discussed how reflection and its expression, in written or oral form, aid the development and utilisation of a bank of skills such as: self-awareness, confidence, motivation and interpersonal skills.

Mathers et al. (1999) demonstrated that a portfolio-based learning scheme, used for continuing medical education activities, gave learners control over how, what and when they learnt, encouraged active and peer-supported learning and built personal and professional confidence.

Wessel and Larin (2006) showed that reflection practice led to increased self-awareness and confidence and to enhanced communication skills in a quantitative and qualitative study with undergraduate physiotherapy students.

Wald et al. (2009) evaluated in a qualitative way the written comments of students about the innovative approach to stimulate reflection applied at the Warren Alpert Medical School of Brown University with a pilot study. The comments showed that reflecting on experiences led to tangible benefits in student-patient interactions.

- Personal and professional development (Gordon 2003)

Gordon (2003) used a portfolio and an interview as assessment tools to evaluate first year medical students' personal and professional development at the University of Sydney. She collected student's opinions on the experience using a questionnaire. Most of the students affirmed that through a reflection process they could foster appropriate personal and professional skills and take responsibility for their own progress as they moved towards becoming competent and reflective practitioners.

- Emotions and feelings as a part of a learning process (Boud and Walker 1998) and qualities required for professional behaviour (Hinett 2002a; Powell 1989)

Professional practitioners such as doctors and dentists have a particular interest in the use of reflection as a way of developing professional behaviour (Hinett 2002a). Particularly reflection-in-action, which has more to do with intuition and feeling than with cognition (Schön 1983), retains an important role in the achievement of this outcome. Emotions, feelings and intuition are important for learning because they lead to the development of personal skills and qualities required for the development of professional conduct.

Powell (1989) attempted to differentiate the levels of reflection in nursing students, using Mezirow's (1991) levels of reflectivity, in order to determine if reflection-in-action was present. The students were observed in practice and then interviewed with unstructured questions. The interviews were taped, the tapes transcribed and analysed by the researcher in a qualitative way. Despite the small sample, the researcher's inexperience and the lack in the evaluation of validity and reliability of

the tool used, this study highlighted some important considerations. Powell (1989) concluded that the learning opportunities in the day-to-day nursing practice for learning from experience were extensive but they were not always identified by the practising nurse. The findings showed that low levels of reflection not associated with reflection-in-action were mainly present. The author explained that the problem was that professional education did not prepare students to learn from these “messy” situations using reflection-in-action.

- Changes in clinical practice (Paget 2001)

Paget (2001) attempted an initial exploration into clinical outcomes consequent to reflective practice. He conducted a retrospective, three-phase, multi-method study in a single nursing department. The research sample included pre and post-registration students of the department who had previously participated in an assessed reflective practice course. Students’ views on the topic were collected from focus-groups, questionnaires and interviews. Qualitative and quantitative analysis of the data showed that practitioners were positive concerning:

- the potential of reflective practice to have a marked influence on clinical outcomes (specific changes to practice, attitudes, communication);
- the important role of the facilitator (faculty) in obtaining clinical changes through reflection;
- the level of experience and year of study having no influence reflective practice.

2.4.4 Reflection and Teaching

Considering the influence of reflection on the development of deep learning, adult learning and professional development learning outcome, it should be stimulated in educational settings, and teaching strategies should be introduced to teach reflection and enable learners to reach the correlated outcomes.

2.4.4.1 Educational initiatives to stimulate reflection

Educational initiatives with different tools (e.g. reflective journals, logs, diaries; portfolios and reflective conversations; PDPs; problem-based learning activities) have been introduced to stimulate students' reflective abilities in undergraduate and postgraduate education of a variety of health professions (Mann et al. 2007).

Reflective writing, discussion and feedback are important factors in facilitating the reflective process.

“Reflective journals, logs, diaries” commonly use a set of prompt questions to get students to reflect in writing (Hinett 2002a, b). However the act of journal writing does not always imply critical reflection. Henderson et al. (2003) explored the attitudes of undergraduate British medical students to reflect in critical incidents used as part of a three-week general practice clinical rotation for 4th year students. Focus groups followed by semi-structured in-depth interviews were conducted and themes developed using a grounded theory approach. This study suggested that resistance to writing reflections might be due to the lack of the mentoring relationship in the process and advocated feedback and guidance as a means of fostering a more in-depth reflective process. Weaknesses of the study are that not all the transcripts from focus groups and interviews were analysed by the same pairs of authors and most of the authors had been involved in teaching in the course, influencing the interpretation of the data.

According to the findings of Henderson et al. (2003), Wald et al. (2009) introduced a novel educational approach within the “Doctoring” course at the Warren Alpert Medical School of Brown University. It was aimed at fostering reflective capacity through encouraging students' structured, longitudinal, reflective writing and providing those students with individualized feedback from an interdisciplinary faculty team and small-group discussion among themselves. Students' responses regarding the experience were requested in written form and a qualitative content analysis of the collected data was performed. Students expressed that the new approach helped to promote deeper and more purposeful reflection. They perceived feedback to have a role in enhancing reflection, building tolerance for uncertainty and helping them to approach their clinical experiences. The small group discussion

was also considered useful because it allowed students to learn from others and sparked the realization that they sometimes shared the same feelings.

There are some other factors that stimulate reflective practice as shown in the following two articles: knowledge of reflective process and of the educational tool used for stimulating reflection. Cole (2005b) affirmed that basic knowledge of reflection represents the first step towards a reflective approach and that a lack of knowledge of “how” to reflect could impair the reflective process required in journal practice.

Grant et al. (2003) evaluated the impact of a medical student learning journal on the development of meta-cognitive skills and to facilitate the connections between the theory and practice. The study used the nominal group technique to evaluate the reflective journal in two consecutive years. Changes were introduced as answer to the students’ responses in the first year and the evaluation at the end of the second year showed a significant reduction in the level of confusion and anxiety related to keeping a diary. The learning journal was perceived to benefit students’ reflection but student training was required.

Qualitative and quantitative studies showed evidence that a “Portfolio” is an effective tool for stimulating reflection in medicine and dentistry (Driessen et al. 2005a; Driessen et al. 2003; Maidment et al. 2006a, b). As with reflective journals real reflection requires a trainer, whose role in the portfolio is crucial and is based on the idea of helping learners think through and explore what has been happening to them not only at a practical level but also at an emotional level.

Driessen et al. (2003) studied first year undergraduate medical students’ perceptions, collected by means of semi-structured interviews, following the use of a portfolio for one year. Major findings were that the coaching by mentors and portfolio structure were necessary for students to learn how to reflect.

Driessen et al. (2005a) discussed the effectiveness of the portfolio in stimulating reflective skills by analysing the viewpoints of experienced medical teachers (13 mentors), obtained in semi-structured interviews. All mentors agreed that compiling portfolios and writing reflective reports fostered a critical attitude in students towards their own performance, and offered directions for further development. The

conditions for successful reflective use of portfolios were: coaching, structure and guidelines, experience and materials, and summative assessment of reflection. Furthermore this study showed that ability, attitude and motivation determine how easily students learned to reflect.

The two part study by Maidment et al. (2006a, b) reported on the potential of the portfolio in supporting reflective practice in dentists. However in these studies assessors expressed a positive opinion regarding the fact that mentors' support was needed for reflection but the dentists in the same study had mixed views. This can be explained by the fact that some of the dentists were close to retirement and not used to reflective writing and others were young practitioners that had been trained using portfolios.

Successful integration of reflective tools into health education might depend upon institutional culture change and a move towards a system which facilitates and rewards reflection in learning.

Hinett (2002b) explained that teaching staff should engage in the process of reflection themselves and should create an environment where students feel safe to reflect, to embrace challenges and accept getting things wrong as part of the process of learning.

Pee et al. (2000) aimed to determine the viewpoints of students and tutors on the development and implementation of a "Progress File" as a tool to stimulate reflection for the dental therapist. They collected the attitudes and experiences on the reflection of a total of 76 students and tutors using interviews and focus groups. Emerging themes were derived from content analysis. Participants expressed concerns regarding the effectiveness and feasibility of Progress File learning within the present educational environment. Students and tutors were really busy and reflection was considered as something additional to their regular teaching and learning activities.

2.4.4.2 The developmental nature of reflection

Driessen et al. (2003) affirmed that reflection can be learned and improved upon and he added that reflection is developmental and not intuitive in his literature review (Driessen 2009).

The hypothesis of reflection being developmental was supported in a quantitative research study involving reflective writing assignments (Duke and Appleton 2000). Various levels of undergraduate nursing students were required to write a piece of reflection on a practice incident related to the module learning outcomes during one academic year. A total of 160 assignments were analysed using a marking grid constructed from literature and the results were compared between students and across academic terms. The results suggested that some reflective skills were harder to achieve than others. Students were more likely to be able to describe practice but had difficulty in critically analysing their practice, learning from it and planning action; skills identified as pivotal to critical reflection. Nevertheless the results illustrated an overall improvement in the degree with which students were able to achieve the reflective skills assessed. The improvement took place between one academic term and the next suggesting that reflection could be effective in short courses as well as longer study programmes.

Although Duke and Appleton (2000) showed that reflection was developmental, future qualitative research was needed to illuminate how this development was achieved and what facilitated and discouraged it.

Wessel and Larin (2006) used a quantitative and qualitative study with the purpose of describing the changes in the reflections of a group of 15 physiotherapy students in the United Arab Emirates from their first to their third clinical placements. They wrote weekly entries in a journal during their first and third clinical placements. A qualitative analysis of the content of all journals was carried out and levels of reflection were assigned using a preformed framework. The levels of reflection and the themes from the two time periods were compared. The students in both semesters demonstrated reflection at levels one to four with a slightly higher mean level of reflection during the third clinical placement; no entries were at level five. Quotes from individual students from both time periods confirmed the changes in reflections. The researchers concluded that writing reflectively improved over time and that the reflection of senior students and clinicians was different compared to reflection of students beginning their clinical experience. They also highlighted that the improvement depended on a good facilitator (faculty) and the development of trust between educators and students.

2.4.4.3 Teaching strategies for reflection

Simply giving the definition of reflection to learners and asking them to reflect is not sufficient; teachers should have a good knowledge about reflection and should teach students how to reflect. Different studies highlighted the fact that it has been very difficult or probably impossible to teach reflection in the traditional way so alternative approaches have been introduced and evaluated.

Race (2002) affirmed that it was unwise to attempt teaching people to reflect. The process of reflection could indeed be illustrated to those whose reflection was to be improved, but, in the final analysis, reflection would remain an individual act in most circumstances. He continued saying that one efficient way of helping people both to reflect and to highlight their reflection could be to provide them with questions. Race (2002) in his paper presented some starting-point questions that could prompt deep reflection.

Considering that it was difficult to get students to reflect at a greater depth (Duke and Appleton 2000; Powell 1989; Richardson and Maltby 1995; Wong et al. 1995), Moon (2001) proposed a two stage guidance process of reflection to help students and gave examples of it in a following article (Moon 2007). There are structures (e.g.: Kolb's experiential learning cycle, Gibbs' reflective cycle) that generally guide the process of reflecting, but they might be said to encourage a relatively superficial form of reflection. Such structures can be helpful to students at the beginning of reflective work and they should be seen as props to be dispensed with as soon as possible. To get learners to deepen their reflection there are a series of exercises that consist of discussing a brief scenario written initially descriptively and then at two or three deeper levels of reflection having a reflective framework.

King (2002) maintained that staff and students needed to develop an awareness of the stages of reflection and suggested how these might be employed to develop better quality reflective writing and more controlled and informed assessment of the writing if required. She used a simplified model of the stages of reflection from Moon (1999) as the basis for two workshops. During the workshops, staff and students were

encouraged to consider the importance of reflection, the development of reflection from the simplest observations to higher levels and then to evaluate pieces of reflective writing for quality. She affirmed, after analysing students' work from the workshops that the key factors in improving the quality of student reflection were: the time necessary to reflect, the knowledge of the process and the stages of reflection, and the assessment thereof. Reinforcement by means of more workshops was considered important to improve the quality of reflective writing.

2.4.5 Depth and level of reflection

Some authors have conceived reflection as a continuum and have discussed reflection in terms of differing depths and levels (Goodman 1984; Ker 2002; Mezirow 1991; Moon 2001; Wong et al. 1995). Several different models exist that describe reflection levels and have been used to evaluate reflective writing. However it is not clear if they can be used as a framework for a marking scheme for the assessment of reflection.

Wong et al. (1995) from a robust study that coded 45 students' reflective journals, following Boud et al. (1985) and Mezirow and Associates' (1990) models of reflection, distinguished three levels of reflection, from the ability to describe and discuss experiences to the ability to be critical as embodied by critical theory.

Naturally the range of reflective ability described by Mezirow (1991) supported the levels of reflectivity described by Wong et al. (1995). However Mezirow (1991) defined three categories of reflective action (content, process and premise reflection) and three categories of non-reflective action (habitual action, thoughtful action and introspection) because he considered it to be important to clearly explain what was not reflection so that all the contents could be accurately assessed. He used these six categories to evaluate reflective writing.

Hatton and Smith (1995) identified four types of writing, three of which were characterised as different levels of reflection: Descriptive writing, Descriptive reflection, Dialogic reflection and Critical reflection. In the same study Hatton and

Smith (1995) started to conceptualize the developmental sequence of reflection in a hierarchical way. They used a framework with five distinctive forms of reflection which could be clearly identified: Technical, Descriptive, Dialogic, Critical, and Contextualization of multiple viewpoints. Starting from the relatively simplistic or partial Technical type, then working through different forms of reflection-on-action (identified in that study as: Descriptive, Dialogic, and Critical) to the ideal end-point of a professional able to undertake reflection-in-action. Reflection-in-action, was conceived as the most demanding type of reflecting about one's own practice, calling for the ability to apply, singly or in combination, qualitatively distinctive kinds of reflection (namely technical, descriptive, dialogic, or critical) to a given situation as it was unfolding.

Moon (2001; 2002b) developed a model for reflection that incorporates one detailed description of four levels of reflection to facilitate the evaluation of reflective writing: 1) Descriptive account, 2) Descriptive account with some reflection, 3) Reflective Writing 1 (Superficial), 4) Reflective Writing 2 (Deep).

Ker (2002) developed a "Multipurpose reflective model" for professional practice in her thesis for the Doctor of Medicine Degree in Dundee. It can be used to describe in a systematic way the inter-relationships of the different simultaneous, multiple functions of reflection in the dynamic context in which clinicians work. She also developed the "Professional Development Reflective Ability" (PDRA) instrument from an action research and a modified Delphi process. The PDRA is characterized by three levels of reflection that define increasing complexity in relation to the students' ability to reflect.

2.5 Portfolio and Assessment

Different reasons for the use of portfolios as assessment instruments in the health care professions alongside the implementation of CBE/OBE curriculum have been reported:

- to drive students' learning in an educationally desirable direction and to identify individual strengths and weaknesses with regards to limits of competence (Challis 2001);
- to be used as authentic assessment (Snadden and Thomas 1998a) of students' performance in practice over a period of time. They allow the collection and integration of evidence on competence and performance from different sources to gain a comprehensive picture of everyday practice;
- to assess students' competence (Gadbury-Amyot et al. 2003; McMullan et al. 2003). Building on the principle of triangulation, all kinds of evidence can be brought together in portfolios that give the possibility of drawing valid conclusions about competence (Tartwijk and Driessen 2009);
- to assess learning outcomes not easily assessed using other instruments. These are integrated and complex abilities such as professionalism, reflective abilities, self-directed learning and self-assessment of personal growth (Davis et al. 2001; Friedman Ben-David et al. 2001);
- to assess aspects of the curriculum such as personal and professional development (Gordon 2003) and communication skills (Rees and Sheard 2004a; Rees and Sheard 2004b);
- to assess programmes by means of the reflection process in order to provide feedback for curriculum improvement (O'Sullivan et al. 2004).

Different methodological problems had to be overcome in order to use the portfolio as an effective assessment instrument. Challis (1999), Baume (2001, 2003), Friedman Ben-David et al. (2001), Davis et al. (2001; 2009) and Driessen et al. (2007b) discussed some desirable features of a portfolio to be used as an assessment tool:

- the portfolio should be structured around the learning outcomes of the programme;

- the evidence of learning should be accompanied by a verbal or written reflective explanation of why each piece of evidence has been included, and the part it has played in the progression of learners' thought and practice;
- the evidence must be ascertainable as either by or about the learner (authentic), multiple and prepared over a period of time in order to support validity;
- the portfolio should be student-centred with the active role of students in directing evidence. The assessment is personalized to support validity and is carried out within a criterion-referenced rather than a norm referenced system;
- there should be criteria for assessment to lead to a certain grade of standardization of the assessment process and support reliability. The criteria should link to specific learning outcomes and represent the benchmarks with which the evidence of learning would be measured. The criteria should be explicit, known to and if appropriate negotiated between learners and assessors. If a portfolio has to be assessed, students should clearly have in mind before they start producing the portfolio the basis on which they will be assessed (the outcomes, the assessment criteria, the standards) and who will see their portfolio (Baume 2003). Adequate internal and external examiners' training on portfolio assessment would also be needed to support reliability;
- a variety of assessment tools is needed to measure the breath of competence. Portfolio assessment should contain quantitative information and qualitative judgement to generate a more comprehensive interpretation of students' achievement;
- multiple examiners should be involved in the assessment process. The assessment panels should be made up of 2-3 assessors depending on the stakes of the assessment. The agreement among raters on the individual units of a portfolio is not so important, raters should agree on a holistic evaluation of the portfolio. A holistic scoring rubric (global performance descriptors) should be used. Furthermore a consensus judgement, obtained by means of a consensus process, should be added to increase reliability of portfolio assessment. External examiners would be less suitable for portfolio

assessment because the familiarity with the educational programme and students' progression ensure the consistency of marking;

- the portfolio should include a clear description of the assessment process;
- the portfolio should include a clear description of assessment criteria and requirements for learners and assessors;
- the portfolio process should provide training on its construction and use for learners and assessors;
- a quality control of portfolio assessment should be present over a period of time and be carried out by an external examiner.

Concerns still exist regarding portfolio assessment relating to:

- its use as summative and formative assessment;
- the students' acceptance of the process (Davis et al. 2009; Mathers et al. 1999);
- its practicability (Davis et al. 2001); its validity (O'Sullivan et al. 2004) and reliability (Pitts et al. 2002).

2.5.1 Summative and formative debate

There is still a debate in the literature regarding the contemporaneous use of a portfolio as a formative and summative assessment tool.

Some articles showed that the use of a portfolio for summative assessment can be successfully combined with its use for learning both at an undergraduate and postgraduate level.

Mathers et al. (1999) developed a portfolio for postgraduate educational accreditation (PGEA) for the comparison with traditional continuous medical education (CME) activities. Thirty-two volunteer general practitioners were divided into two cohorts. Each cohort spent six months following a traditional route to PGEA and six months following a portfolio-based learning route based on the completion of learning cycles and supported by three CME tutors. Qualitative and quantitative evaluation data were collected by questionnaires, semi-structured interviews, participants' observations

and reviews of completed portfolios. The results of the study showed the acceptance of the principle of portfolio-based learning and an improvement of the portfolio approach over traditional PGEA. Mathers et al. (1999) also demonstrated that a portfolio based learning scheme could also be used for summative assessment of learning outcomes within the context of an individually created learning plan.

Driessen et al. (2005a) demonstrated that summative assessment improved learning obtained through portfolios. They designed a portfolio that was aimed at stimulating reflection in early undergraduate medical education. One of the conditions for reflective portfolio use, which were identified through interviews with 13 mentors, was summative assessment of portfolios.

The results of other articles highlighted some doubts regarding the usability of portfolios as summative assessment tools without interfering with the goal of stimulating and supporting reflective learning. However in most of the following articles there is an attempt to address the formative-summative conflict of portfolio assessment.

McMullan et al. (2003) concluded in their literature review that the use of the portfolio as a formal assessment in nursing changed the way learners compiled the portfolio, resulting in a reduction in its learning value.

Snadden et al. (1996), through an action research project with trainers and general practice registrars, reported that participants perceived that formal assessment would inhibit the type of material collected in the portfolio, but it was noted that these perceptions were not substantiated by any differences in portfolio content.

Kjaer et al. (2006) carried out a study with a cohort of postgraduate medical trainees and an on-line portfolio, with 79 portfolio users and 11 not users. They developed and validated two questionnaires (one for users, one for not users) which collected both quantitative and qualitative data. They found that 71% of portfolio users feared they would be less honest and avoided showing shortcomings, if their notes were used for assessment purposes. Kjaer et al. (2006) concluded that the e-portfolio was a

good basis for formative assessment and recommended that a part of the portfolio should be kept exclusively for formative feedback (private part of the portfolio) and one for summative assessment (public part of the portfolio).

The qualitative studies above showed the problems in using the portfolio both for learning and assessment. However they enrolled first-time users of the portfolio, whose reactions could differ from the steady-state situation, and they did not include the trainers' perspective.

The following study analysed tutors' opinions on the issue. Ellis et al. (2006) evaluated the use of a reflective portfolio within a pastoral tutor system to facilitate undergraduate PDP. The evaluation was undertaken using focus groups of tutors about the implementation of a reflective portfolio into the school of Dental Sciences in Newcastle. The transcripts were analysed using a thematic deductive framework approach. Self-review and meetings with tutors were both considered important elements for dental students' PDP. The tutor has a number of roles within the process of self-review such as providing support, structure and monitoring of the process, giving perspective and facilitating students' identification of their own strengths and problem areas. Tutors affirmed that students should not perceive the process of review and PDP as a summative assessment because this might become detrimental to the student-tutor relationship regarding to "pastoral issues". However the role of a mentor in portfolio assessment is not that of a pastoral tutor.

2.5.2 Student reaction to Portfolio assessment

The initial feeling of participants' uncertainty and resentment towards portfolio learning and assessment is a common finding of different studies (Ellis et al. 2006; Kjaer et al. 2006; Snadden et al. 1996). However the following study showed the presence of a positive attitudinal change over time, although it is only based on students' perceptions.

Davis et al. (2009) used a questionnaire containing statements and open questions to obtain feedback from students at the University of Dundee Medical School, Scotland. The objectives of this study were to identify and analyse students' attitudes to the

portfolio assessment process over time. There were different reasons that contributed to a significant increase in student anxiety at the beginning of the experience. The students had doubts regarding some learning outcomes around which the portfolio was structured (reflection, professionalism) and about the fairness of the examination. They also felt that portfolio building interfered with clinical learning; they thought that there was too much paperwork in the portfolio process and that it was time-consuming.

The refinement of the portfolio content, a student induction emphasising reflection and professionalism and the development in the external world leading to students' familiarity with the portfolio process, contributed to the improvement of students' attitudes towards the portfolio learning and assessment. The change took time and was not easy but reflects the willingness of the medical school in Dundee to allow the portfolio assessment to evolve with other methods of assessment for the evaluation of learning outcomes (Davis et al. 2001). In some other contexts the use of portfolio assessment is crossed by an evident resistance to change, due to a traditional way of thinking regarding assessment.

2.5.3 Portfolio structure and practicability

The importance to create a portfolio for assessment directly related to learning outcomes of the programme was recognized in different studies.

The study of Davis et al. (2009) highlighted that the Dundee Medical School portfolio was explicitly structured around the 12 exit learning outcomes of the programme.

Driessen et al. (2006; 2003) identified a clear portfolio structure related to learning outcomes as one of the key ingredients contributing to the effectiveness of the portfolio assessment of undergraduate medical students in Maastricht, the Netherlands.

Gordon (2003) used the portfolio and an interview to assess students' personal and professional development at the Faculty of Medicine in Sydney and evaluated students' opinions about the experience using a questionnaire. She produced a list of prompts to help students with the content of portfolio; student-centred learning was encouraged as an active process in the portfolio. Those prompts, although not explicitly outcomes in nature, provided a structure for the portfolio. Most of the students' responses in the questionnaire confirmed that they could foster appropriate personal and professional skills and take responsibility for their own progress as they moved towards becoming competent and reflective practitioners.

2.5.4 Validity and reliability of Portfolio assessment

Portfolios have a highly individual nature and the process of assessment does not fit neatly with the traditional concept of assessment founded on objectivity within health education. The subjectivity of portfolios has to be accepted in order to create and therefore assess them (Challis 1999). The portfolio is an individual creation where the learner, provided with some guidelines, is free to decide what learning to document and pursue. This represents a problem for the reliability of the portfolio summative assessment, which is one of the weaker aspects of portfolio use in education (Driessen et al. 2003). There are three strategies that may improve the reliability of portfolio assessment: portfolio standardization, rater training and the structuring of judgement using analytical criteria and multiple assessors. The introduction of more specific guidelines leading to portfolio standardization and of criteria with which assessment would be carried out, in order to decrease the personal aspect of the portfolio, might restrict what learners put into the portfolio, and reduce its value, certainly as a tool for their development (Driessen et al. 2003). Increasing the number of assessors is an expensive strategy for most educational institutions (Driessen et al. 2003).

The introduction of portfolio assessment in different areas of health education led some authors to recognize it as a valid and reliable assessment tool, whereas others expressed more doubts.

Portfolios are claimed to have high face and content validity for assessment of learning outcomes because they allow the collection of evidence from different sources and over a period of time. However there are conflicting opinions about the acceptability of portfolio assessment.

Mathers et al. (1999) developed a portfolio for postgraduate medical educational accreditation (PGEA). The breadth of topics covered in the portfolio was extremely wide and entries were seen to be appropriate for the claimed educational objectives. Participants considered the portfolio as a valid tool for the assessment of learning outcomes.

The small scale pilot by Maidment et al. (2006a, b) found some concerns about the use of a portfolio for revalidation to meet dental professional body requirements. Some of the participants of the pilot group (10 general dental practitioners) felt that “revalidation (using a portfolio) doesn’t prove you are a good or a safe dentist, it proves you can fill a book”. The assessors noted that the quality of the evidence was adequate but they concluded that when using the portfolios for revalidation the scheme would be significantly enhanced by the appraisal of the dentists, thus triangulating the data and its interpretation.

Portfolio assessment has potential for assessing a range of outcomes not easily assessed by other methods; for example, attitudes, reflection and professionalism. The triangulation of the portfolio with other assessment methods is a strategy raised by some authors to improve the validity and reliability of portfolio assessment.

Melville et al. (2004) reported ratings of 76 paediatric SpRs’ portfolios. Portfolios were rated according to the quality of evidence presented and expectations by year of training and a marking scheme, based on Bigg’s SOLO taxonomy, was used. In the first year, portfolios were assessed by a single rater, and the following year by two raters. Trainee performance was also assessed in the annual Record of In-Training Assessment interview (RITA). Inter-assessment correlation between RITAs and portfolios was small, suggesting that portfolios had a place as part of a triangulation process with other assessment methods. The method of portfolio assessment used

was also insufficiently reliable for high stakes without multiple observers (assessors) or observations.

The series of articles by Pitts et al. (1999; 2001; 2002) reported reliability studies of the portfolios and illustrated the difficulties encountered in attempting to use traditional psychometric views of reliability and validity for portfolio assessment.

In the first study of Pitt et al. (1999), the 12 participants took a course comprising of five separate days, each about 3-4 weeks apart. Participants used loose guidelines about portfolio content. The eight assessors, who received training before the experience, used six assessment criteria, related to learner-centred education, incorporated into a marking schedule and scored with a 6-point Likert scale. A judgement was sought from the assessors on whether and to what degree these criteria could be seen in the portfolio together with an overall global pass/refer judgement, as to whether the portfolio was deemed to be satisfactory. All the assessors examined all the portfolios on two occasions, one month apart. Assessors attended a debriefing workshop after the project to discuss and record their experiences and identify the points of difficulty. Detailed information was reported: all the scores for all the criteria for all the participants; inter-rater reliability (k); intra-rater reliability (k); results of assessment by pairs of assessors. This work has shown that the consistency of individual assessor's judgements was moderate, but inter-rater reliability did not reach a level where a summative judgement could be made safely.

Pitts et al. (2001; 2002) made efforts to increase inter-rater reliability in two following studies. They offered a framework to participants for defining and addressing problems using a reflective practice mode, which did not lead to any change in reliability (Pitts et al. 2001). In 2002 they introduced a discussion between assessors that only resulted in the modest improvement in reliability (Pitts et al. 2002).

Overall they have shown that despite explicit instructions to compilers, considerable investment in assessor training, and the negotiation, agreement and publication of

criteria, individual assessments were consistent but showed only fair inter-rater reliability and were untrustworthy in high-stakes assessment.

Furthermore, Pitts et al. (2002) expressed the opinion that applying measures such as reliability and validity was not appropriate for evaluation of portfolio assessment, and a different approach should be evaluated.

Johnson (2004) discussed the different approaches to portfolio assessment (e.g. positivist, interpretivist) and the assumptions underlying them.

In a positivist approach to assessment there is the belief in the possibility of objectivity, scientific measurement and certainty. The researchers assume that it should be possible to reach one ideal, objective assessment of a portfolio through appropriate criteria, training of assessors and construction of clear guidelines. The concepts of reliability and validity are the quantitative criteria of this approach.

In the interpretivist approach to assessment, the realities are perceived as mental constructions or interpretations, rather than absolute, objective truths. Lincoln and Guba (1985) agreed that “truth” is a matter of consensus among informed and sophisticated constructors, not of correspondence with an objective reality. They suggested alternative, more qualitative criteria for judging the adequacy of evaluation such as: credibility, dependability and transferability.

Johnson (2004) also mentioned the need for both qualitative and quantitative criteria in evaluating portfolio assessment.

Because of the nature of portfolio data and the need to rely on personal judgment and the results obtained by previous studies (Pitts et al. 1999; Pitts et al. 2001; Pitts et al. 2002), Webb et al. (2003) concluded that an alternative approach to assessing a portfolio (interpretivist approach) should be used, based on qualitative criteria of rigour. They mapped definitions for qualitative research criteria (credibility, transferability, dependability etc.) to types of portfolio evidence and examined their use in four case studies. They found that in all cases the assessment process successfully identified students who were struggling and tracked their remediation over a period of time, and in one case, was used to fail a student.

These criteria were then used by Driessen et al. (2005b) to assess undergraduate medical education portfolios. They used triangulation, prolonged engagement, and

member checking for reaching credibility; audit trail and dependability audit for realising dependability. Rather than looking at consistency across repeated assessments, the new approach involved adding information to the judgment process until saturation of information was reached (holistic professional judgement). Saturation meant that additional information did not add anything new so conclusions were the same. The concept of psychometrics, particularly in relation to multiple assessors, was not ignored, but it was not applied in a classic test theoretical sense. This article represented a major shift in thinking and approaching the assessment of competence, and enhanced the usability of portfolios as an assessment tool without interfering with the goal of stimulating and supporting reflective learning.

Driessen et al. (2007b) in their systematic review of portfolios in medical education suggested that it was possible to achieve acceptable inter-rater reliability with assessment that was grounded in small groups of assessors, special assessors training exercises, discussion among the raters before and after the assessment and the use of global qualitative criteria with rubrics. They gave an average reliability of 0.63 of six studies cited and showed that increasing the number of raters raised the reliability towards a value of 0.8, as was usually required for high stake decisions.

2.5.5 Assessment of Professionalism

The dictionary definition of professionalism is simple: “the conduct, aims, or qualities that mark a profession or professional person (Springfield 1991)”. Adding a health care slant, we may further define it as a life characterized by display of high intellectual, technical, and moral qualities and abilities, in service to patients and community (Masella 2007).

The working party of the Royal College of Physicians (RCP) devised a definition of professionalism for the medical profession that highlights the essential professional qualities of doctor (Royal_College_of_Physicians 2005). An amended form of this definition for dentistry (Trathen and Gallagher 2009) describes a dentist who is both a professional and a business person on the grounds that keeping the business

working well is part of the social corporate responsibility for the benefit of all the patients treated there:

“Dental professionalism signifies a set of values, behaviours and relationships that underpins the trust the public has in dentists.

Dentistry is a vocation in which a dentist’s knowledge, clinical skills, and judgement are put in the service of protecting and restoring oral, dental and social well-being. This purpose is realised through a partnership between patient and dentist, one based on mutual respect, individual responsibility, and appropriate accountability.

In their day-to-day practice, dentists are committed to:

- Integrity
- Compassion
- Altruism
- Continuous improvement
- Excellence
- Working in partnership with members of the wider healthcare team.

These values, which underpin the science and practice of dentistry, form the basis for a moral contract between the profession and society. Each party has a duty to work to strengthen the system of oral and dental healthcare on which our collective dignity depends, within the context of a realistic economic framework that will permit the extension of this system to all those in need both now and in future”.

Professionalism has been inserted as a learning outcome in different professional programmes. Professionalism was identified as personal and professional development learning outcomes and was included in the outcome-based model curriculum for dentistry as part of the 12 curriculum outcomes of a Scottish dentist at graduation (Clark et al. 2004b).

Despite much work in medicine (Jha et al. 2007), there has been very little investigation of the methods of facilitation and assessment of professionalism in the dental undergraduate curriculum within the UK.

Field et al. (2010) reported in a commentary regarding the teaching and assessment of professionalism in the UK dental schools that the methods involved were largely traditional, relying on lectures and seminars taught throughout the course for

teaching and on grading and providing formative feedback after a clinical encounter for assessment.

Reflective ability is a key component of professionalism on the basis of Schon's (1983) work in relation to the development of the reflective practitioner for professional practice.

Reflection is embedded in both humanitarian and scientific perspectives of professionalism (Ker 2002). It enables humanitarian attributes such as altruism, integrity, honesty and commitment and critical evaluation of competences to be integrated into clinical practice in a more balanced way.

The relationship between reflective ability and professionalism facilitate the development and assessment of professional ability (Ker 2002) by means of a reflective portfolio.

The reflective portfolio provides an ideal context to assess reflective ability as a key component of personal and professional development. During the portfolio assessment, students' ability to reflect in relation to their personal portfolio evidence can be assessed over a longer period. Reflective writing for a portfolio assessment demonstrates students' experience separated from their personal interpretation leading to a modified students' perception of the experience (Eisner 1991). This facilitates the integration of new and prior knowledge and the organisation of experiences in relation to the outcomes that need to be achieved. In addition, the analysis of reflection writing summaries enables students' identification of their strengths and weaknesses toward the achievement of the learning outcomes of the programme.

2.5.6 Assessment of Reflection

The increasing recognition of reflection as a key factor for health professionals has led to its embedding into the curricula as one of the learning outcomes of professional programmes. In the map of module development in a study programme (Moon 2002a), learning outcomes imply assessment criteria and assessment

processes, thus reflection should be assessed. However the very personal nature of the reflective process implies the use of specific assessment tools and qualitative criteria in the assessment of reflective abilities. The introduction and evaluation of the new assessment tools for reflection in professional health programmes have raised some issues about the process of reflection assessment.

2.5.6.1 Summative assessment of reflection

There are still doubts regarding the acceptability of the assessment of reflective ability, particularly when the meaning of this assessment is not well understood.

Pee et al. (2002) discussed whether a formal assessment of reflection was desirable to indicate whether courses were succeeding in developing reflective practitioners and appraised the utility and effectiveness of a technique intended to engage students in reflection. They examined 26 dental therapy students' reflective thinking using an activity called "A learning experience" (ALE) based on a structured worksheet. A qualitative, multi-method approach was taken. Worksheets were evaluated by the two researchers independently using two different sets of criteria for the assessment of reflection derived from the literature and by peers using their own criteria. Inter-judge agreement was calculated between the two researchers. Opinions of students regarding acceptability and utility of the activity were collected using a questionnaire. They found that ALE facilitated reflection and that students demonstrated reflection at deeper as well as descriptive level. However they questioned if summative assessment of reflection could negatively influence students' reflection practice and they suggested a qualitative approach to evaluate assessment of reflection.

Richardson and Maltby (1995) studied nurses' ability to reflect in a qualitative and quantitative way. They analysed reflective diaries completed over a 4 week period by nursing students in the second year of their programme and interviewed some of them in a focus group. They used Powell's (1989) tool, based on Mezirow's levels of reflectivity, to evaluate reflection assuming that it could be also appropriate for reflective writing samples assessment. Inter-rater reliability was established by the

exchange of a random sample of the diaries between the two researchers. The study found that students were able to reflect but the majority of the reflections were at levels one, two and three. These are levels concerned with the description of experience, feelings and evaluation of care without the presence of higher level skills of critical enquiry and problem solving. The analysis of the data from the focus group suggested that reflection is stimulated by reflective diaries but assessment could inhibit the development of reflection. However Richardson and Maltby (1995) showed that without assessment, students might be unwilling to engage in reflective activities, and that a clear understanding of the purpose of the assessment might overcome that concern.

Along the same line Moon (2002b) sustained that the mark would not have a negative effect on reflection if the meaning of the assessment of reflection was well understood. She affirmed that the purpose of the assessment of reflection could be to evaluate students' ability to reflect or the product of the reflection. She continued saying that it was needed to clearly explain to students that they would be assessed on their ability in the reflection process and not on the product of the reflective process.

2.5.6.2 Strategies to provide evidence of reflection

It is still not clear which is the most adequate strategy to encourage the development of reflective capacities and provide clear evidence of reflection in literature. Writing is often used as a way of capturing reflection-on-action but another way is through verbal interaction (Hinett 2002a). Observation followed by discussion represents the major way of analysing reflection-in-action (Powell 1989; Schön 1983). However Hatton and Smith (1995) affirmed that experienced professionals can recall and describe the reflective thought processes going through their heads while an event was occurring.

Hatton and Smith (1995) developed criteria of reflection from the analysis of teacher students' writing in form of essays in the Sydney study. They also interviewed students, with structured questions, seeking their evaluation of the various strategies

which had been used in the study to encourage reflection. Results from the analysis of written essays demonstrated that the largest proportion of coded units were descriptive reflection. They explained how difficult it was to differentiate between reflective students that did not show it in the text, or students that were not reflective but had a writing style which was generally recognised as reflective. They pointed out that reflective writing should be judged in terms of criteria for the recognition of reflection and not in terms of standard academic writing conventions. They also indicated that in their study a powerful strategy for fostering reflective action was the verbal interaction with a trusted person. Consequently they proposed that verbal interaction could be used as a way to judge students' reflective abilities. Similarly Korthagen (1993) described individual and small group discussion as appropriate strategies for recognising different forms of reflection. Furthermore there is evidence that using reflective writing to assign students to broad reflective levels gives results consistent with using an interview (Wong et al. 1995). However verbal interaction may not be applicable when large numbers of students are involved in the assessment process (Sumsion and Fleet 1996).

2.5.6.3 Rigour in assessment of reflection

According to evidence-based practice in education, research is needed to appraise the validity and reliability of the tools used in the assessment of reflection. There are few instruments that have been proven to be consistent in terms of inter-rater reliability for the assessment of students' reflective abilities (Boenink et al. 2004; Burnett et al. 2008; Kember et al. 1999; Wong et al. 1995).

Wong et al. (1995) attempted to develop and test a marking system for written reflection journals based on two well-known models of reflective thinking (Boud et al. 1985; Mezirow and Associates. 1990). After an induction of two hours, three coders carried out a content analysis of 45 nursing students' reflective journals using the two coding systems. In depth interviews were also conducted to illuminate students' reflective abilities. The authors concluded that a reflective journal could be used to demonstrate the presence or absence of reflective thinking. The process of allocating students to three categories of non-reflector, reflector and critical reflector

(Mezirow and Associates. 1990) was reliable but allocating textual elements within the journals to finer levels of reflection (Boud et al. 1985) was less reliable. Reliability was analysed using the Inter-Judges Agreement (IJA) percentage (Miles and Huberman 1994). The study showed that reflectivity was mainly at a low level, that critical reflection was harder to achieve and that the number of years of working did not appear to have an effect on the level of reflectivity. However, experience in this sense (numbers of years of working) does not necessarily implicate learning.

Kember et al. (1999) aimed at devising a method for assessing the kind of reflective thinking which students undertake in programmes for professional education. They proposed a scheme for estimating the quality of reflective thinking using very well defined categories based on Mezirow and Associates' (1990) work. This established the validity of the marking categories. Representative sections were taken from the journals of students enrolled in four undergraduate degree programs in nursing, occupational therapy, physiotherapy and radiotherapy. After discussion of the categories for a correct interpretation and definition, the scheme was evaluated in an initial test where reasonable levels of agreement were obtained from eight judges using Cronbach alpha as index of internal consistency. The second step was to test the scheme in a direct practical application, showing acceptable levels of reliability between four assessors. However the sample of the first text was constituted by reflective writing taken from the journals of only three first year students and the number of the students that took part in the practical application is small.

Others conclusions were:

- disagreements over marking which resulted from the differing interpretations of the significance of what students had written rather than from a lack of precision in the guidelines for marking categories;
- only one of the judges taught the course from which the journal entries were taken and was familiar with the students and the context. If the methods were to be used for assessment purposes it would be more likely to be used by those teaching the target course so the assessors would be better placed to interpret the journal entries;

- the process was also of value in the evaluation of the courses. It provided a means of determining whether the various teaching and learning strategies for encouraging reflective thinking were succeeding.

Boenink et al. (2004) described the development of an instrument to measure the ability of medical students to reflect on their performance in medical practice. A total of 195 4th year medical students attending a 9-hour clinical ethics course filled in a semi-structured questionnaire consisting of reflection-evoking case vignettes. Two independent raters scored their answers. They concluded that reflection in medical practice could be measured using the semi-structured questionnaire built on case vignettes. The inter-rater reliability calculated using the Pearson's r correlation coefficient was sufficient. Women had slightly higher scores than men, as had students with work experience in health care, and students considering general practice as a career (t-test was applied). These differences found between groups of students were as expected and supported the validity of the instrument.

Ker (2002) affirmed that reflective ability should be assessed because it was a major component of "Professional and Personal Development" and was one of the learning outcomes a student should achieve to become a doctor in Dundee. She developed an instrument to assess reflective ability called PDRA assessment instrument and analysed the content and construct validity and the reliability of this instrument.

The PDRA has been validated as an assessment instrument of reflective ability by Ker et al. (2003), and for a portfolio context it was a useful contribution in assessing professional development. She selected two validated instruments to determine construct validity of the PDRA instrument in a cohort of final year medical students. Significant correlation, using Pearson's correlation coefficient, was found between the PDRA instrument and the Perry's intellectual growth score, particularly in relation to student ability to monitor their own progress.

Burnett et al. (2008) studied the reliability of the PDRA. The study illustrated how an instrument to assess the reflective ability of final year medical students was applied to the context of hand hygiene within the infection control cleanliness champion

programme and demonstrated inter-rater reliability using Cohen's kappa at all three levels of reflection. One hundred and thirty two reflective accounts were used for this study, provided by 44 5th year medical students. Each student had written three reflective accounts for the hand hygiene unit. Three raters, trained in a one-hour workshop, assessed the reflective accounts independently. Two raters reviewed each reflective account. Results showed that the inter-rater reliability was consistently high for all three levels of reflection. However, the least consistent was at the reflective level three and this could indicate that assessors might require more skills and knowledge to enable effective and consistent examination of all areas of reflection.

Sumsion and Fleet (1996) raised a number of implications concerning the assessment of reflection. They investigated the extent to which student teachers enrolled in an early childhood literacy unit demonstrated a reflective approach to their professional development. Data were collected from student teachers four times during the year-long unit. They used a rating scale with three levels of reflection described as highly reflective, moderately reflective, and not reflective in their study. To ensure inter-rater reliability, the data were coded by each of the teacher educators and a research assistant. Following an initial meeting of the three raters to establish consistency, coding was undertaken blindly. Despite attempts prior to marking to ensure inter-coder reliability, only 50% inter-rater reliability was achieved representing a low level of reliability. They also did not explain in the study how they had calculated inter-coder reliability.

They concluded that:

- reflection appeared unsuited to quantitative measurement. These instruments were unlikely to result in a high degree of inter-rater reliability;
- rating scales, which depended on ease and reliability of use for their effectiveness, might be able to provide a reliable means of identifying evidence of reflection, but were unable to provide many insights into the complex nature of reflection (different levels of reflection);
- it might be preferable for an instrument to identify reflection to be used by only one rater, rather than averaging the ratings of several raters. Marking

reflection is dependent on a high degree of interpretation; there might be more consistency if only one rater was involved.

However Kember et al. (1999) explained that the categories of reflection used by Sumsion and Fleet (1996) in their study were not as well defined as they had claimed, and this is probably the reason why the study had achieved low levels of inter-rater reliability in assessment of reflection. Furthermore, they did not explain what method was used to calculate inter-rater reliability in the study.

A common weakness of the studies above is that they only carried out a quantitative evaluation of the instruments used to assess reflection, without considering a qualitative analysis that could be appropriate because of the personal nature of the reflective material. It is clear that well defined criteria and multiple collection of evidence over time are necessary, but some doubts still exist regarding students' and assessors' acceptability of the process, the right person to assess students' reflective abilities, the number of assessors and the process of assessors' calibration.

2.6 Research Methodology

2.6.1 Quantitative and Qualitative research approaches

The nineteenth century debate in science about how best to study and understand the world brought two research designs: quantitative and qualitative (Patton 1990).

There are three ways in which quantitative and qualitative research methods can be considered as complementary instead of as mutually exclusive alternatives (Pope and Mays 1995). Firstly, quantitative research can be applied to verify theories brought up by a qualitative study. Secondly, both methods can be used in the same study either to address different research questions or in a process of validation. Thirdly qualitative research can explore phenomena not practicable by quantitative research.

Cresswell (1994) talked about three different research designs: quantitative, qualitative and mixed methods. The research problem is emphasized and in the mixed methods researchers use both quantitative and qualitative data to understand the problem.

2.6.2 Objectivity and Subjectivity

Objectivity is very important and achievable in quantitative research method, data are collected, analysed and reported without being affected by the researcher (Bower and Scambler 2007).

Whereas the debate on the fact that objectivity is desirable and achievable continued in qualitative research, some qualitative researchers recognize that the subjectivity of the researcher is intimately involved in qualitative research. Subjectivity guides everything from the choice of the topic that one studies, to formulating the hypotheses, to selecting methodologies, and interpreting data. This subjectivity brings one of the advantages of qualitative research: the ability for greater depth of analysis (Blinkhorn et al. 1989).

2.6.3 Research design in the Qualitative approach

A range of qualitative approaches exist and they have their own philosophical and ideological underpinning and a preferred methodology used to answer different research questions (Grbich 1999b; Silverman 2005).

The qualitative approach “Evaluation research” represents the third and fourth steps in the theory-to-action research continuum: Basic research > Applied research > Summative evaluation > Formative evaluation > Action research. Once problems are identified by Basic research and solutions are designated to intervene in society and bring changes by Applied research, Evaluation research is intended to examine and judge the processes and outcomes aimed at attempted solutions (Patton 2002a).

There are two types of evaluation research: summative and formative evaluation. Summative evaluation serves to judge if an intervention is effective or not and implies a summit decision about the fact that the intervention could continue and move to other situations. Summative evaluation usually relies on quantitative and qualitative methods (Patton 2002b).

Formative evaluation serves the purpose of improving the intervention being studied, without the attempt of generalizing findings beyond the setting where evaluation takes place. It usually relies on qualitative methodology (Patton 2002c).

2.6.4 Sampling and the possibility of generalizing the study results

Non-probability techniques, such as purposive sampling, are usually employed in qualitative research because data collection is generally time consuming and expensive. Purposive sampling allows the choice of a case rich in information in which the researcher is interested (Patton 1999). Patton (1990) lists a variety of purposeful sampling strategies, each with different implications for the kinds of findings that will be generated. In “critical case sampling” people that can provide the most information on the topic are chosen as a sample of a study.

The sample in qualitative research is usually represented by a small number of participants and it is not representative. The possibility of generalizing the findings to a wider population is not usually an aim in qualitative research (Bower and Scambler 2007) and Schonfield (1993) argues it is interpreted as comparability and transferability. Therefore it is important in qualitative research to provide a clear, detailed, and in-depth description of the research methodology so that others can decide the extent to which findings from one piece of research are applicable to another situation (Schonfield 1993).

2.6.5 Data collection

Qualitative research prefers less structured, open-ended data collection techniques with structuring taking place later through content analysis that is usually long (Cohen and Manion 1989; Fraenkel and Wallen 2006).

2.6.5.1 Interview

The scope of the research interview is to explore the views, feelings, beliefs and behaviours of individuals concerning specific matters (Gill et al. 2008). Interviews are an appropriate method of data collection for studying phenomena which little is known about, for obtaining deep insight from participants or exploring sensitive topics (Gill et al. 2008). There are three types of interviews: structured, semi-structured and unstructured. Structured ones (referred as verbal questionnaire) consist of a series of predefined questions asked to a participant in the same way whereas in unstructured interviews (referred as “in depth” interview) the interviewer starts the interview with a limited number of questions and frames the others on the basis of interviewee’s responses (Mathers et al. 1998). Lincoln and Guba (1985) suggest that the structured interview is useful when researchers are aware of what they do not know and therefore are in a position to frame questions that will supply the knowledge required, whereas the unstructured interview is useful when researchers are not aware of what they do not know, and so rely on the respondents to tell them.

The semi-structured interview involves a series of open-ended questions based on the topic areas the researcher wants to cover, also allowing for the supplying of new information from the participants that was not previously thought by the researcher (Gill et al. 2008; Mathers et al. 1998). Semi-structured interviews tend to work well when the interviewer has already identified a number of aspects he/she wants to be sure of addressing (Mathers et al. 1998).

2.6.5.2 The Focus Group

The focus group is a group of individuals brought together to discuss a particular topic for research purpose (Chestnutt and Robson 2001; Gill et al. 2008). A fundamental element of the focus group, in contrast with other methods of group interviewing, is the interaction between group members, building up ideas and the concepts discussed (Chestnutt and Robson 2001).

Elements that need to be taken into consideration in conducting a focus group are (Chestnutt and Robson 2001; Gill et al. 2008):

- the recommended size of a focus group is six to eight persons;
- the members of the focus group should have something in common;
- participants might or might not know each other;
- researchers need to give due consideration to the impact of the group dynamics on the data collected;
- time scheduled for focus groups should be 1-2 hours and should be told to participants in advance;
- the location chosen for the focus group should be informal, comfortable and free from distractions;
- there should be an interview guide where questions are organized from general to specific and on the basis of their importance in the research issue;
- moderators should be expert, permit all participants to contribute in the discussion and keep the discussion on track using prompts and probes;
- adequate data recording (tape record and notes).

2.6.5.3 The Questionnaire

The questionnaire is an economic tool that permits the collection of data from a high number of participants in a relatively short time (Cohen and Manion 1989).

The questionnaire can be structured and semi-structured. The term unstructured is misleading to describe a questionnaire as the whole devising of a questionnaire requires respondents to adhere to some form of given structure (Cohen and Manion 1989).

A structured questionnaire, with closed questions (dichotomous, multiple choice questions, rating scale etc.), can generate frequencies of response amenable to statistical treatment and analysis (Cohen and Manion 1989).

In semi-structured questionnaires a series of questions, statements or items are presented and respondents are asked to answer, respond to or comment on them in a way they think best. These less structured, open-ended questionnaires may be more appropriate in a site-specific case study as they can capture the specificity of a particular situation (Cohen and Manion 1989).

Among different types of close-ended questions, rating scales can be useful for tapping attitudes, perceptions and opinions. They combine the opportunity of a more sensitive response while still generating numbers which can be analysed in a quantitative way (Cohen and Manion 1989).

A Likert scale (named after its deviser, Rensis Likert 1932) provides a range of responses to a given question or statement, but there is no way of knowing if the respondent might have wanted to add any other comments about the issue under investigation because respondents need to select from a given choice (Cohen and Manion 1989). The inclusion of open-ended questions represents an opportunity for respondents to reply in their own terms and opinions (Cohen and Manion 1989).

2.6.6 Data analysis

There are two fundamental approaches to analysing qualitative data: the deductive approach and the inductive approach (Burnard et al. 2008; Spencer et al. 2004). Deductive approaches use a predetermined framework to analyse data. This approach is useful in studies where researchers can foresee probable participant responses; it is quick and easy but it can bias the whole analysis process as the framework has been decided in advance. The inductive approach (Glaser and Strauss, 1967) involves analysing data without a predetermined framework and uses the collected data themselves to derive the structure of analysis. It is time-consuming and is most suitable where little or nothing is known about the study phenomenon.

Content analysis defines a strict and systematic set of procedures for the rigorous analysis, examination and verification of the content of written data (Cohen and Manion 1989). Content analysis takes texts, reduces them into summary form using both predetermined framework and emergent structure in order to generate or test a theory (Cohen and Manion 1989).

Thematic content analysis is the most basic type of qualitative analysis, it analyses the content of the data collected to categorize the recurrent or common themes. Green and Thorogood (2004) describe the different steps of thematic content analysis:

- identifying themes and categories that emerge from the data collected;
- analysing themes and categories to refine and reduce them in number by grouping them together;
- creating a coding scheme by labelling the themes (the coding scheme can also be predetermined);
- using the coding scheme to divide up all the data collected (cut and paste, side mark coding, colour coding);
- rearranging all the sections of the data into categories;
- writing the report of the finding from this organized dataset.

Furthermore Shenton (2004) advocates some other steps to facilitate thematic content analysis:

- the creation of a data dictionary. It is a list of categories and codes associated that provide descriptions of concepts represented. The data dictionary can be thematic in arrangement: it consists of a series of sections, each of which is devoted to one of the objectives of the study. The data dictionary permits a better definition of each category and facilitates the comparison between them;
- construction of a database of data codes. After coding the transcript text and “text notes” a database record can be created using for example “Microsoft Access”. Each record should include fields such as: the transcript identifier, biographical information on the participants and coding terms (example: category codes). The database allows the tracing of all the transcript text

sections related to a category and to search via the range of fields leading to the identification of patterns and investigation of their prevalence;

- creation of concept webs. This involves the examination of the codes associated with each category listed in the data dictionary and the arrangement of the concepts into webs to indicate the relationship between them. The one advocated by Miles and Huberman (1994) involves “clustering” by conceptual mapping. This analysis of the relationships between the categories may lead to other changes in the categories and codes associated. The concept webs may be seen as the first attempt to develop a “whole” from the data collected and it is a guide for structuring the writing up of the study’s results.

Miles and Huberman (1994) also talk about the graphic display of qualitative data as a method of summarizing and showing them to other people.

Thematic analysis is also the basis of more sophisticated qualitative analysis, in which the researcher moves beyond simply categorizing and coding the data to thinking about how the codes relate to each other and asking more complex questions (Green and Thorogood 2004). Two potential ways of developing a deeper analysis of qualitative data are Framework analysis (Ritchie and Spencer, 1994) and Ground theory (Glaser and Strauss 1967). The key difference between these two methods of analysis is that in the first the integrity of the individual respondents’ accounts is preserved throughout the analysis, rather than in the latter there is an attempt to “fracture” the data in order to open up new avenues for analysis (Green and Thorogood, 2004).

Qualitative analysis can be very time-consuming, so a number of software packages have been designed to help the researcher. However such programmes do not analyse the data for the researcher, they simply manage the data and permit the researcher to retrieve it quickly (Burnard et al. 2008). They are particularly useful if there is a large amount of data (Green and Thorogood 2004).

2.6.7 Validity and reliability in education research

Validity refers to the appropriateness, meaningfulness, correctness, and usefulness of the specific inferences researchers make based on the data they collected (Fraenkel and Wallen 2006).

Reliability refers to the consistency of scores or answers from one administration of an instrument to another, and from one set of items to another (Fraenkel and Wallen 2006).

The terms reliability and validity are normally common criteria of quality in quantitative research approaches.

Lincoln and Guba (1985) have systematically replaced traditional criteria of quality for quantitative research by a set of parallel methodological criteria for qualitative research:

- credibility: confidence in the ‘truth’ of the findings (validity);
- transferability: showing that the findings have applicability in other contexts (generalisability);
- dependability: showing that the findings are consistent and could be repeated (reliability);
- etc.

Different methods to increase rigour in qualitative research (Barbour 2001; Mays and Pope 2000; Patton 1999) are available but they are effective only if they are embedded in a broad understanding of qualitative research design and data analysis (Barbour 2001).

2.6.7.1 Triangulation

Triangulation may be defined as comparing different methods, theories, data sources or investigators (Huston and Rowan 1998). Qualitative researchers generally do not use triangulation as a method for validation or verification but as a technique to ensure that an account is rich, robust, comprehensive and well-developed.

Patton (1999) identifies four types of triangulation:

Triangulation of methods. Checking out the consistency of findings generated by different data collection methods such as observation, interviews, focus groups and questionnaires for the same research question. Triangulation of methods also includes the use of qualitative and quantitative data in a study. Quantitative and qualitative research can be fruitfully combined when they elucidate complementary aspects of the same phenomenon.

Triangulation of sources. Examining the consistency of different data sources from within the same method. For example:

- at different points in time;
- in public vs. private settings;
- comparing people with different viewpoints.

Analyst Triangulation. Using multiple analysts to review findings or using multiple observers:

- this can provide a check on selective perception and illuminate blind spots in an interpretive analysis;
- the goal is not to seek consensus, but to understand multiple ways of seeing the data.

Theory/perspective triangulation. Understanding how findings are affected by different assumptions and fundamental premises. It is performed using multiple theoretical perspectives to examine and interpret the data.

2.6.7.2 Respondent Validation

Participant validation involves returning to participants and asking them to carefully read through their interview transcripts to avoid misinterpretation and through data analysis to validate, or refute, the researcher's interpretation of the data (Pope and Mays 1995).

2.6.7.3 Multiple coding

Multiple coding concerns the same issue as the quantitative equivalent “inter-rater reliability”. It is a response to the potential subjectivity present in the process of qualitative data analysis and helps to provide additional insight into theme and theory development. This process can be carried out by a researcher alone, by a team or by involving independent experts in reviewing and exploring interview transcript, data analysis and emerging themes (Barbour 2001).

A limit of multiple coding is shown by Armstrong et al. (1997) in his study where although six experienced researchers who independently coded one focus group transcript showed substantial agreement, he found considerable variation in the ways that they packaged coding frameworks (including the language used). Therefore it is improbable for different researchers, given the range of their disciplinary backgrounds and interests and the complexity of qualitative data, to analyse and interpret the data in the same way.

However the greatest potential of multiple coding lies in its capacity to furnish alternative interpretations alerting researchers to all potentially competing explanations.

2.6.7.4 Negative case or alternative explanations

Once the researcher has analysed the data and found explanations, it is important to look for cases that do not fit within the pattern and for alternative explanations in order to increase the validity of the study (Holloway and Wheeler 2002).

2.6.7.5 The audit trail

Since the methods used in research, the context in which the research is carried out and the researcher unavoidably influence the findings, a clear account of these elements in the research report enables external checks increasing validity and

applicability to other situation of the study findings (Mays and Pope 1995, 2000; Patton 1999).

Rodgers and Cowles (1993) describe four types of audit documentation:

- the contextual should provide a description of the setting, people and location of the research;
- the methodological should describe the sampling process and the process of data collection to allow the reader to judge whether the data collected is adequate to answer the study question;
- the analytical should give a clear account of the process of data analysis. This allows the reader to judge whether the interpretation proffered is adequately supported by the data;
- the personal response should describe the background characteristics (age, sex, social class, and professional status), the competence (training, experience and preparation) of the researcher and his/her predispositions, selective perceptions and personal and intellectual bias.

2.7 Summary and aims of the project

If we look from 1970s' America to the competence-based system in Australia and Britain during the 1990s', what is striking are the huge similarities between the model developed by Americans, and that promulgated by British and Australians. However there are dramatic differences between the institutional structures which characterized the United States on the one hand, and the UK and Australia on the other; and which have produced differences in consistency and speed of implementation and growth in competence-based programmes.

Competence-based or Outcome-based movements were produced by the same motivating forces and apart some dissimilarity, particularly in the origins of their appearance, they led to very similar changes in the curriculum of professional programmes.

In CBE/OBE the curriculum is organized by broad specific and generic competences/outcomes that represent what students have to achieve at the end of a programme and work as a guide for learning, teaching and assessment in the curriculum.

The orthodontic postgraduate programme in Cardiff has been engaged in the process of revision of the curriculum. The learning outcomes for the orthodontic SpRs were derived from those identified by the University Teachers Group of the British Orthodontic Society and the SAC in orthodontics (Clark et al. 2004b).

However the learning outcomes in Cardiff were not “specific. They did not suggest the level of competence that individuals should have achieved in a particular moment during the three years, which is one of the factors in guiding the system of students’ assessment. Furthermore, the introduction of generic learning outcomes in the curriculum requires appropriate methods of assessment that were not present in Cardiff.

Staff members’ agreement on “specific” learning outcomes and appropriate methods of assessment would sustain the concept of “constructive alignment” (Biggs 2002) facilitating the revision of the orthodontic curriculum in Cardiff.

The concept of holistic learning, which is clearly evident in both competence-based and outcome-based movements, led to the development of new educational tools to stimulate and assess the generic competences/outcomes.

The different definitions and models of reflection that appeared over the years (Boud et al. 1985; Ker 2002; Kolb 1984; Moon 1999; Schön 1983) show an increasing relationship between reflection, learning, personal and professional development learning outcomes.

Portfolios with a reflective component, usually called PDP, have been introduced because they may encourage adult and self-directed learning and the connection between theory and practice, which are an integral part of professional education and development (Gardner and Aleksejuniene 2008; Moon 2001; Snadden and Thomas 1998b). They may also be used as formative assessment tool for the achievement of

the learning outcomes (Challis 2001) and as summative assessment tools for reflection (Friedman Ben-David et al. 2001).

The evaluation of portfolios in nursing, medical education and dentistry demonstrated some issues regarding their acceptability (Davis et al. 2009; Driessen et al. 2007b; Duque et al. 2006; Gardner and Aleksejuniene 2008; Garrett and Jackson 2006; Kjaer et al. 2006; Pee et al. 2000; Ranson et al. 2007); however there is no evidence in the orthodontic field.

The success of portfolios as learning and assessment tools depends on overcoming a number of obstacles (Tartwijk and Driessen 2009):

- portfolio is a time-consuming process and a lot of energy must be invested by learners and mentors (Davis et al. 2009; Tartwijk and Driessen 2009);
- learners approaching portfolios need support not only in portfolio building but also in the process of recording reflection (Driessen et al. 2003; Snadden and Thomas 1998a);
- learners and teachers often do not see the relevance in reflective learning and assessment of reflection (Davis et al. 2009; McKimm 2001);
- there are some concerns about technical difficulties related to the use of an e-portfolio (Gardner and Aleksejuniene 2008);
- there are barriers to using a PDA version of an e-portfolio in a clinical environment (e.g. loss, limited memory, interface restrictions) (Garrett and Jackson 2006; Lindquist et al. 2008; Ranson et al. 2007).

Successful integration of a reflective e-portfolio into professional education might depend upon institutional culture change, a move towards a system which facilitates and rewards reflection in learning and assessment (Davis et al. 2001; Davis et al. 2009; Pee et al. 2000) and a high quality IT infrastructure and support.

Another common aspect of competence and outcome-based movements is a Holistic approach to the evaluation of competences or outcomes using different methods of assessment.

Wolf (1995) defined competence-based or outcomes-based assessment as a form of assessment that is derived from the specification of a set of both specific and generic

competences/outcomes. Students' progress is certified on the basis of the demonstrated achievement of these competences/outcomes.

The heart of Competence-based assessment is face validity (MgGaghie 1991): a close correspondence between the assessment situation and the situation in which the candidate will one day operate. However the reliability of the professional performance assessment may be a problem. It is necessary to assess students more than once using different assessment methods, multiple well-trained assessors, consensus judgement and global qualitative criteria (Driessen et al. 2007b).

The portfolio has been introduced as a form of professional performance assessment to assess professionalism (Friedman Ben-David et al. 2001; Gordon 2003). The reflective portfolio provides an ideal context to assess reflective ability (Ker 2002), which is a key component of personal and professional development (professionalism) (Moon 2001; Schön 1983).

Issues exist regarding the process of reflection assessment:

- the effect of summative assessment of reflection on students' reflection practice (Moon 2002b; Pee et al. 2002; Richardson and Maltby 1995);
- the most adequate strategy to provide clear evidence of reflection (observation, reflecting writing, verbal interaction) (Hatton and Smith 1995; Hinett 2002a; Schön 1983);
- the changes of students' reflective abilities over time (Duke and Appleton 2000; Paget 2001; Wessel and Larin 2006; Wong et al. 1995);
- assessors' calibration process before assessing students' reflective abilities (Burnett et al. 2008);
- one or more assessors involved in the evaluation process (Boenink et al. 2004; Burnett et al. 2008; Kember et al. 1999; Sumsion and Fleet 1996; Wong et al. 1995);
- who should assess students' reflective abilities (Kember et al. 1999; Sumsion and Fleet 1996).

The evaluation of reflective material, which is open to interpretation by the examiners, required the introduction in the portfolio of new assessment instruments. Ker (2002) developed the PDRA assessment instrument to assess reflective ability

and analysed its validity (Ker et al. 2003) and its reliability (Burnett et al. 2008). The study of Burnett et al. (2008) showed that the inter-rater reliability of the PDRA assessment instrument was consistently high but that it might be opportune to evaluate if more assessors' skills and knowledge of the PDRA would improve the examination of different levels of reflection. Furthermore, it would be appropriate to carry out an evaluation of students' and assessors' acceptability of the PDRA instrument considering that previous studies lack of this aspect.

Based upon the foregoing the aims of this project are:

- to achieve a staff member's consensus on "specific" learning outcomes and assessment methods of the curriculum in the context of the postgraduate orthodontic programme in Cardiff;
- to highlight students' and supervisors' feelings about a reflective e-portfolio instituted in the postgraduate orthodontic programme at Cardiff dental hospital;
- to investigate students' and mentors' attitudes at Cardiff to the introduction of a reflective e-portfolio as a formative and summative assessment tool for reflective abilities, professionalism and learning outcomes.

Chapter 3 Learning Outcomes and Assessment

3.1 Introduction

“Constructive alignment” (Biggs 2002) and staff members collaboration (Manogue and Brown 2007) needed to be promoted in the postgraduate orthodontic programme in Cardiff to achieve an effective revision of the curriculum according to the OBE approach.

Staff members working together to achieve an agreement on “specific” learning outcomes and appropriate assessment methods, which facilitate the alignment process in the orthodontic curriculum in Cardiff, was the aim of the first part of the project.

The objectives were:

- to develop a list of learning outcomes and appropriate assessment methods;
- to ask staff members to judge the appropriateness of the learning outcomes for the specialist orthodontic training, to specify the level to which these learning outcomes were to be achieved and the best assessment method that were to be used to evaluate them;
- to evaluate the staff members’ agreement on the components of the curriculum cited above.

3.2 Method and Materials

3.2.1 Introduction

The Delphi technique was chosen in the first part of this project in order to achieve the study aim. It can provide the most reliable consensus of opinion of a group of experts without the bias which could readily occur in comparable techniques, such as committee meetings or group discussions (Dalkey and Helmer 1963; Williams and

Webb 1994). Some individuals can be intimidated or inhibited from expressing their view because stronger personalities can dominate the meeting or the group. Moreover, because successive rounds of information reach each panel member, views can be retracted, altered or added with the benefit of considered thought (McKenna 1994; Reid 1988; Williams and Webb 1994).

In particular, given that different staff members acted as curriculum designers, teachers, and assessors within the orthodontic specialist training in Cardiff, a Delphi methodology was chosen for appraisal due to its potential to simultaneously explore similarities and differences held between different staff members, and to enhance collaboration and curriculum alignment.

This technique has recently applied with reasonable success in studies with similar purposes. It allowed a panel to reach consensus of opinion about a core syllabus improving curriculum alignment in the context of a postgraduate sports medicine training programme conducted by the Australian College of Sports Physicians (Fallon and Trevitt 2006).

3.2.2 The learning outcomes list and the assessment methods

The information from literature was used to develop a list of learning outcomes for a specialist orthodontist and the assessment methods to assess them. In defining the learning outcomes the author considered the OBE approach (Harden et al. 1999b) that Clark et al (2004) applied to dentistry. It allowed flexibility in teaching, learning and assessment encouraging students to take more responsibility for their learning.

A design-down approach was used to compile a hierarchical list of outcomes explaining the level of performance expected at different stages of the training programme. The list provided a clear overview of the whole orthodontic training programme in Cardiff and the students' expected progress, and could be used as a basis for assessment.

The list comprised of “Main Outcomes” that were collected under three “Essential Elements” headings. The main outcomes were, in turn, made up of a series of more detailed “Learning Outcomes”.

The essential elements represented the aspects of a competent and reflective orthodontist:

- what the orthodontist is able to do;
- how the orthodontist approaches his/her practice;
- the orthodontist as a professional.

The main outcomes represented the abilities that needed to be achieved at the end of an orthodontic postgraduate programme. Each main outcome was related to one of the three essential elements (Table 3.1).

ESSENTIAL ELEMENTS	RELATED MAIN OUTCOMES
WHAT THE ORTHODONTIST IS ABLE TO DO	Clinical information gathering Diagnosis and orthodontic treatment planning Treatment procedures Orthodontic treatment evaluation
HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE	Patient management Communication Health promotion Health and safety Information handling Ethical behaviour Legislation Decision making, clinical reasoning and judgement Management of research Application of basic sciences
THE ORTHODONTIST AS A PROFESSIONAL	Professional development Personal development

Table 3.1: The essential elements and the related main outcomes. Based on the study of Harden et al. (1999b)

Each main outcome was then further subdivided into learning outcomes. The learning outcomes were the quantified and qualified range of assessed achievements for postgraduate orthodontic students at the end of each year of their structured training programme.

The concept of Competency Continuum recognised the Novice-Expert journey to becoming a professional as passing through five successive stages and lasting ten-fifteen years (Chambers 1994). The author, using the information found in literature, (Chambers 1993, 1994, 1995, 1998; Chambers and Geissberger 1997; Chambers and Glassman 1997) defined the criteria for each stage of the journey (Table 3.2).

CRITERIA OF THE NOVICE-EXPERT JOURNEY			
	WHAT THE ORTHODONTIST IS ABLE TO DO	HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE	THE ORTHODONTIST AS A PROFESSIONAL
NOVICE	<ul style="list-style-type: none"> •Rule follower •Clinical skills are not integrated •Slow performance and frequent errors •Frequent advice and/or help to complete the performance •Not responsible for carrying out of performance 	<ul style="list-style-type: none"> •Knowledge of isolated facts •No clinical reasoning •No critical thinking •No understanding in decision making •Little professional contact with patients and staff 	<ul style="list-style-type: none"> •Requires help and guidance to reflect appropriately on the experience •Extrinsically rewarded •Superficial identification with the profession
BEGINNER	<ul style="list-style-type: none"> •Less rule follower •Some integration of clinical skills •Few initiatives and choices among alternative responses •Quicker performance and less errors •Some advice and/or help to complete the performance •Not responsible for carrying out of performance 	<ul style="list-style-type: none"> •Increase in number of known facts and procedures •Some integration and synthesis of facts •Little clinical reasoning •Little critical thinking •Have difficulty applying what is learned in one context to another •Little understanding in decision making •Some professional contact with patients and staff 	<ul style="list-style-type: none"> •Able to reflect on experience with minimal help •Little approach to the profession
COMPETENT	<ul style="list-style-type: none"> •Integrated clinical skills •Respond to the range of variation normally encountered •Reasonably accurate and fast •Little or no advice to complete the performance •Independent performance 	<ul style="list-style-type: none"> •Increase in number of known facts and procedures •Deep understanding and integration of facts •Clinical reasoning •Critical thinking •Can apply what is learned in one context to another •Understanding in decision making •Maintains professional contact with patients and staff 	<ul style="list-style-type: none"> •Able to reflect on experience and identify positive learning aspects unaided •Intrinsically rewarded •Beginning of internalized standards of professionalism
PROFICIENT	<ul style="list-style-type: none"> •Matching one's interest and skill set to alternative environments •Respond to a wider range of problems •A little more accurate and faster •No advice to complete the performance •Independent performance 	<ul style="list-style-type: none"> •Increase in knowledge •Greater depth of understanding and reorganisation of facts •Quicker clinical reasoning in some situations •Easily maintains professional contact with patients and staff 	<ul style="list-style-type: none"> •Can reflect easily on experience and identify future self development needs •Focused on goal of patient care •Internalisation of standards of professionalism
EXPERT	<ul style="list-style-type: none"> •Flexible •Scheme driven •Respond to the most unusual problem •Accurate and fast •No advice •Independent performance 	<ul style="list-style-type: none"> •Internalisation of facts and procedures •Quicker clinical reasoning in most situations 	<ul style="list-style-type: none"> •Performer responsibility •Highest level of professionalism

Table 3.2: The criteria for each stage of the Novice-Expert journey

Any one of these stages could be applied to each learning outcome. At any point in the programme it was possible to compare where the students were and where they should have been in their professional growth, providing both staff and students with a transparent record of progression (Table 3.3).

WHAT THE ORTHODONTIST IS ABLE TO DO	Year		
	1st	2nd	3rd
Diagnosis and orthodontic treatment planning			
Guiding the developing occlusion	B	C	P
Adult patient	B	C	P
Cranio-mandibular dysfunction patient	N	B	C
Restorative and periodontal patient	N	B	C
Orthognathic patient	N	B	C
Malocclusion and medical problem	N	B	C
Diagnose and classify common craniofacial anomalies	N	B	C
Treatment planning of common craniofacial anomalies			B

Table 3.3: A section of the outcomes list organisation for an orthodontist student in Cardiff

The main outcome is “Diagnosis and orthodontic treatment planning”. It is broken down into 8 different learning outcomes, and it is suggested that for each learning outcome students should be at a determined level (Novice-N, Beginner-B or Competent-C) by the end of each year of the study programme.

Each learning outcome in the list had an explanatory list of “Topics” indicating its nature (Table 3.4).

	YEARS		
	I	II	III
Interview of patient, relatives and others (child or adult)	C	P	P
Patient’s chief complaint			
Anticipated compliance			
Medical history			
Dental history			
Social history			
Physical growth evaluation (chronological age, biological age)			

Table 3.4: A section of the outcomes list organisation for an orthodontist student in Cardiff (topics)

“Interview of patient, relatives and others (child or adult)” is the learning outcome and it is broken down into 6 different topics.

The assessment of the main outcomes could be achieved by evaluating students in specific situations. Assessment of students in specific tasks became assessment of a prescribed group of learning outcomes, hence learning outcomes represented what students should be assessed on to perform the full range of tasks that orthodontists

might meet in their practice. Naturally it would not be possible to assess all the learning outcomes during a programme. The school could choose which learning outcomes needed to be assessed in order to verify that students had achieved all the main outcomes.

Chambers and Glassman (1997) suggested that different types of evaluations were suited to the different stages of professional growth. The best way of evaluating a novice was different to that of the evaluation of beginner or competent students. Different methods of assessment should be used to evaluate different levels of learning outcomes. The chosen learning outcomes could be evaluated by a system of assessment that became more and more integrated along students' progress (Hager 1995). For example, the outcome "Functional appliance" might be assessed by a "MCQ-Extended Matching" during the first year of the orthodontic postgraduate programme. It might be assessed by an "Objective Structured Clinical Examination" during the second year and by a "Patient management problems" during the third year. In the example only one learning outcome has been considered but multiple learning outcomes might be assessed in the same task or performance. The further along in the Novice-Expert journey, the greater would be the integration of learning outcomes (Clark et al. 2004, 2004b).

3.2.3 The Delphi technique

Essentially the Delphi technique consists of questioning a panel of experts on specific issues (McKenna 1994; Williams and Webb 1994). Information concerning the issue is sent individually to each panellist, who then responds to the researcher. This procedure is anonymous and confidential. After they respond, the data are summarised and a new questionnaire is designed based solely on the results obtained from the first questionnaire. This second questionnaire is returned to each panellist and they are asked to reconsider their initial opinion and to return their responses to the researcher once again. Repeat rounds of this process are carried out until the consensus of opinion, or point of diminishing returns, has been reached (McKenna 1994; Williams and Webb 1994). However it has to be considered that the Delphi

technique tends to eliminate extreme positions and can force a middle-of-the road consensus.

The Delphi technique and the purposes for which it has been used have been extensively modified by researchers over the years. As a result, several different types of Delphi techniques are identified such as the “classic”, the “policy” and the “decision Delphi” (Rauch 1979); the “numeric” and the “historic” (Reid 1988); and the “real-time Delphi” (Beretta 1996). Many of these are concerned with the creation of items by respondents.

Another adaptation, the “reactive Delphi”, involves asking respondents to react to previously prepared information rather than to generate lists of items (McKenna 1994). Despite the fact that this approach could bias the responses or limit the available options; it was used in this study. A clear advantage of commencing the process in this way was that it would minimise the workload for participants making a potentially time consuming technique more efficient (Williams and Webb 1994).

3.2.4 The size and sampling of the panel

The Delphi technique employed “Experts” in the area in which the researcher is interested as members of the panel. Sackman (1975) claimed that any group of informed individuals could furnish Delphi’s opinions indistinguishable from those of the experts. According to Goodman (1987) it would be more appropriate to recruit individuals who have knowledge of a particular topic and who are consequently willing to engage in discussion about it without the potentially misleading title of “Expert”.

Often the selection of the sample involves non-probability sampling techniques, either purposive sampling or criterion sampling.

In this study the panel members were representative of a group defined by criteria (Reid 1988) and were recruited on the basis of their knowledge about the study topic and their possible interest in the study.

Taking into consideration the aim of the present study the panel members were expected to fulfil all of the following requirements:

- to currently be a staff member of the orthodontic training programme in Cardiff;
- to be a specialist in orthodontics and to demonstrate continuous professional interest in orthodontics;
- to make an active contribution to the educational needs of postgraduate students in orthodontics;
- to make an active contribution to the assessment of postgraduate students in orthodontics.

The size of the Delphi panels can vary to an extraordinary degree. Reid (1988) expressed two concerns about panel size:

- the generalization of results from small Delphi panels;
- the dropout response rate from large panels that raised worries about response bias.

In those studies that have selected a random sample from a larger population the response rates seemed to have been disastrous (Reid 1988). In a more recent study (Burke et al. 2009) a modified two round Delphi survey was used to identify the key knowledge, skills, and attitudes in genetics for general practice speciality training. Burke et al. (2009) involved randomly selected general practice trainers, programme directors, and geneticists (total number =60) and the response rate was 63% after the first round and 65% after the second round.

Another characteristic of the panel is its heterogeneity. According to Moore (1987) a heterogeneous sample should be used to ensure the entire spectrum of opinion is determined.

Nine staff members who contributed to the taught postgraduate programme in orthodontics in Cardiff were identified. The panel was small but heterogeneous; it included consultants, a professor, a reader, a lecturer and a “Fixed Term Training Appointment” (FTTA) student (Appendix I).

3.2.5 Anonymity

Complete anonymity, when no one (including the researcher) can link a response to a respondent, appears to be a generally held principle in most Delphi surveys. However Sackman (1975) argued that it could lead to a lack of accountability for the views expressed, and Goodman (1987) maintained that it encouraged hasty ill-considered judgements. Furthermore, because of the iteration process inherent in the Delphi technique an individual panel member's responses should be unknown to other participants but they should be known to the researcher. McKenna (1994) termed this "quasi-anonymity" and it was used in the present study so to allow the follow up of non-respondents experience using reminders.

3.2.6 The Delphi rounds

The original Delphi technique consisted of four rounds. It was shortened to two or three rounds to suit individual research aims because it was difficult to retain a high response rate within a Delphi process that had so many rounds (Keeney et al. 2001). Recently Rohan et al. (2009) used a three round Delphi technique to develop a consensus of consultants on an optimal anaesthesia, intensive care and a pain medicine curriculum for medical undergraduates. The response rate to the first round was 100%. Sixty seven per cent of consultants responded to the second questionnaire and 59% to the third questionnaire.

It was considered that two rounds would be enough to reach adequate consensus in this study because:

- the initial document already contained pre-existing information on the outcomes and the assessment methods;
- all the panellists, working in the same orthodontic department, would potentially have similar views on the outcomes and the assessment methods;
- it would guarantee to retain a high response rate (Rohan et al. 2009).

3.2.7 Round one

The information collected from literature was used to compile the document for Round 1, which consisted of three parts:

- an invitation letter;
- an explanatory section;
- a questionnaire.

The explanatory section provided the panellists with:

- sufficient, understandable information about the nature and the purpose of the first part of the research study and how it would be conducted;
- the reason they had been chosen to participate, their role in the study and the consequences of the research study;
- assurance of the fundamental ethical principles of confidentiality.

3.2.7.1 Questionnaire design

The questionnaire contained 126 items divided into three sections (Appendix II):

- essential elements and main outcomes (16 items);
- learning outcomes and progress (77 items);
- assessment methods for each stage of the Competency Continuum (33 items).

In section 1 the panel members were asked to rate the need for each main outcome to be an included component of the orthodontic training programme in Cardiff. In section 3 the panellists were asked to rate the appropriateness of different assessment methods of evaluating students at each stage of the Competency Continuum. A four point scale, anchored by “strongly agree” and “strongly disagree”, was used in section 1 and 3. In section 2 the panellists were asked to suggest the sequence of levels that should be attained for each learning outcome during the three year orthodontic training programme using the following Novice-Expert scale: N: Novice; B: Beginner; C: Competent; P: Proficient; E: Expert.

Free comments on each item and suggestions about adding or deleting items were also invited.

3.2.7.2 Questionnaire distribution

The document for Round 1 was distributed by post to the panel members. All the members were asked to participate in the study, to complete the questionnaire and to return it within three months using the stamped addressed envelope accompanying the questionnaire in an invitation letter (Appendix III).

Reid (1988) recommended a follow-up of non-responders in order to keep a high response rate. Beretta (1996) suggested that reminders could cause responders to feel forced into returning the questionnaire, without due consideration of their responses. A reminder letter (Appendix IV) was sent out to all the panel members three months later, thanking those who had participated and giving a new deadline for any outstanding replies. Round 1 was concluded almost seven months after the distribution of the questionnaires.

3.2.7.3 Data collection

The author manually scored the questionnaires received, obtaining quantitative and qualitative data on the outcomes at each year of the orthodontic programme and the assessment methods for each stage of the Competency Continuum.

3.2.7.4 Quantitative analysis

In the Delphi technique the quantitative analysis provides a statistical summary of the panellists' view of the items. It is often achieved by ranking items according to their median, mean, standard deviation or mode (Shiffman et al. 2003; Williams and Webb 1994).

An important issue among researchers planning to use the Delphi technique is the understanding of what is meant by "consensus". Definitions of consensus within the Delphi studies extend from "true" consensus to majority rules. Many researchers do not attempt to set a level for consensus prior to the enquiry. They make a decision after the data have been analysed. The concept of consensus is arbitrary and, unless a value (or range of values) is stipulated, the notion of a "high" level of consensus can

be a movable feast which is unilaterally decided upon by the researcher (Williams and Webb 1994).

The data from Round 1 questionnaires was analysed and patterns of agreement were identified using one of the measures of central tendency called the “Mode”. The mode was used because the statistical analysis had to point out the score which occurred most often in a set of ratings in order to identify the level of agreement (Clegg 1990). Furthermore in section 2 the ratings were not numbers but the five levels of Competency Continuum preventing the use of other measures of central tendency such as mean and median.

The level at which panel agreement was considered as consensus was 55%. In Round 1 this criterion for consensus was set after the data had been analysed. A definition of consensus, based on the most frequent rating for each item and the criterion for consensus specified, was generated.

3.2.7.5 Qualitative analysis

Where the panel members provided comments, they were carefully considered in order to refine items’ wording or to include additional items where the panellists felt significant omissions arose.

3.2.8 Round two

The Round 2 questionnaire was constructed in such a way as to minimize the workload for the panellists. It was not considered opportune to ask the panellists to reconsider the items that had already achieved consensus after Round 1, so they were not included in the Round 2 questionnaire. Three items with consensus were re-presented in Round 2 because the panel members’ ratings suggested the exclusion of these items from the original lists. The aggregation of Round 1 results and subsequent development of a Round 2 questionnaire occurred over a period of two weeks.

3.2.8.1 Questionnaire design

The Round 2 questionnaire (Appendix V) contained 31 items from the Round 1 questionnaire that had to be reconsidered. It was organised into three sections:

- essential elements and main outcomes (Round 1 results were shown);
- learning outcomes and progress (26 items);
- assessment methods for each stage of the Competency Continuum (5 items).

In section 1 the panel members were presented with the results from the Round 1 questionnaire, but were not required to take any action. In the other two sections they were asked to re-rate the 31 items, using Novice-Expert scale in section 2 and the 4 point scale, anchored by “strongly agree” and “strongly disagree”, in section 3. The Round 2 questionnaire reminded the panellists of their own Round 1 rating for each item and presented the group’s mode rating for that item. They were also asked to clarify their decision by additional comments on each item.

3.2.8.2 Questionnaire distribution

The Round 2 questionnaires were distributed by post to the panel members. The Round 2 questionnaires were only sent to those who responded to Round 1 because they did not contain all the items present in Round 1, even though posting it to non-responders could increase the response rate.

All the members were asked by a covering letter (Appendix VI) to complete the questionnaire and to return it within two months using the stamped addressed envelope accompanying the questionnaire. A follow-up letter (Appendix VII) was sent out to all members of the panel one month later, thanking those who had participated and requesting any outstanding replies. After another month a reminder email with a new deadline was sent to those members who had not yet returned the questionnaire. The Round 2 was concluded four months after the distribution of the questionnaires.

3.2.8.3 Data collection

The author manually scored the questionnaires received, obtaining quantitative and qualitative data on the outcomes at each year of the orthodontic programme and the assessment methods for each stage of the Competency Continuum.

3.2.8.4 Quantitative analysis

The same definition as consensus of Round 1, based on the mode and the criterion for consensus specified (55%), was used to include or exclude items in the new lists of outcomes and assessment methods. In Round 2 the criterion for consensus was set before the data were analysed.

3.2.8.5 Qualitative analysis

Where the panel members provided comments, they were carefully considered in order to understand clearly their decision and to take a decision on the items that showed a lack of consensus after Round 2.

At the end of Round 2, panellists were sent details of the outcome of the Delphi process by post as a matter of courtesy.

3.3 Results

3.3.1 Quantitative Analysis

The number of panel members responding to both rounds of the Delphi process is shown in Table 3.5. The table also gives details of the number of professors, readers, consultants, lecturers and FTTA students included in each round showing the heterogeneity of the panel. In Round 1 two questionnaires (22.2%) were initially returned with a further five (55.6%) being received after the reminder. Two consultants did not return their questionnaires. The Round 1 questionnaire was sent

to all those who responded to the Round 1 questionnaire. In Round 2 100% of the sent questionnaires were returned. Four of these (57.1%) were obtained thanks to the use of two reminders.

STAGES OF DELPHI PROCESS	MEMBERS OF THE PANEL					
	Professors	Readers	Consultants	Lecturers	FTTA students	TOTAL
starting	1	1	5	1	1	9
ROUND 1						
without reminder			1	1		2
after 1 reminder	1	1	2		1	5
ROUND 2						
without reminder	1	1	1			3
after 1 reminder			1	1		2
after 2 reminders			1		1	2

Table 3.5: The panellists involved in each stage of the Delphi process

From a starting point of 126 items consensus was achieved for 98 (77. 8 %) items after Round 1 and for 124 (98. 4%) after Round 2. Consensus for an item was defined as the most frequent rating (mode) that represented at least 55% of all the ratings for that item.

All the 16 items in section 1 obtained consensus after Round 1. Consensus was not achieved with 24 items in section 2 and 4 items in section 3 (Table 3.6). Consensus to be excluded from the lists was achieved for “Decision making” and “Psychology in orthodontics” in section 2, and “Examining Board” used for Novice in section 3. No new item was introduced in the Round 1 questionnaire.

The breakdown of the 31 items which were re-proposed in the Round 2 was (Table 3.6):

- 26 items in section 2 (24 items without consensus and 2 with achieved consensus to be excluded from the final documents);

- 5 items in section 3 (4 items without consensus and 1 with achieved consensus to be excluded from the final documents).

At the end of Round 2 consensus was achieved for 29 of the 31 items (Table 3.6). Two of these items achieved consensus to be excluded from the final document. The excluded items were both from section 3. One was “Examining Board” used for Novice students and the other was “Poster presentation” used for Beginner students. The two items without consensus whose mode did not represent 55% of all the ratings were “Decision making” in section 2 and “Examination Board” used for Beginner students in section 3.

ROUNDS	SECTIONS			TOTAL
	section 1	section 2	section 3	
ROUND 1				
starting items	16	77	33	126
items with consensus	16	53	29	98
items without consensus	0	24	4	28
ROUND 2				
starting items	0	26	5	31
items with consensus		25	4	29
items without consensus		1	1	2

Table 3.6: Items with and without consensus in each section and after each round of the Delphi process

3.3.2 Qualitative Analysis

Considering the comments obtained in Round 1 the wording of five items, 1 in section 2 and 4 in section 3, were changed (Figure 3.1).

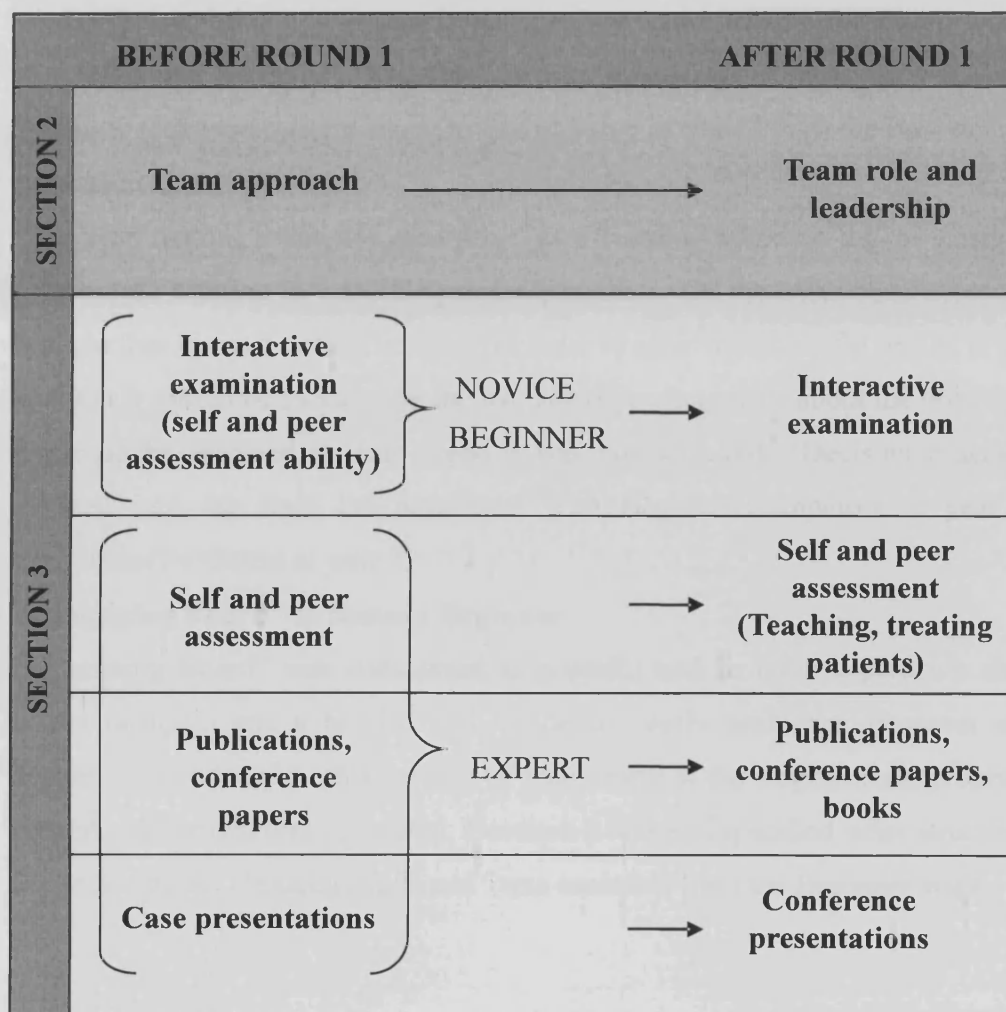


Figure 3.1: Wording changes

The comments obtained in Round 2 provided a better understanding of why some items were excluded and why for some items consensus was not achieved. On the basis of those comments a decision was made on the items excluded and those where consensus was not achieved.

“Examining Board” to assess a Novice

The use of an “Examining Board” to assess a Novice was considered a little daunting by most of the panel members and therefore that method of assessment was excluded from the Novice stage.

“Poster presentation” to assess a Beginner

“Poster presentation” was considered as a useful tool for individuals to develop structured thoughts, organize and present them. However the comments highlighted

“Poster presentation” as an assessment method more suitable for Competent rather than Beginner students. Therefore “Poster presentation” was moved from the Beginner to the Competent stage instead of being excluded from the final document.

“Decision making”

“Decision making” was not considered as a learning outcome for the postgraduate orthodontic training in Cardiff by some panellists. On the other hand most of them thought that it was a critical outcome in order to achieve successful results in practice and that it should be included in the list. However consensus about the level at which it should be assessed at year 1 and 3 was not achieved. “Decision making” was inserted into the final list associated with Beginner/Competent at year 1 and Competent/Proficient at year 3.

“Examining Board” to assess a Beginner

“Examining Board” was considered as a useful tool to build a person’s ability to accept criticism and a helpful tool to identify early problems. However students should be introduced to this method of assessment at the Beginner stage only if it is properly structured and calibrated. Because it was not specified what structured and calibrated meant, “Examining Board” was excluded from the Beginner stage.

3.3.3 The final document

A final list of outcomes for the specialist orthodontist in Cardiff and a final version of assessment methods appropriate at various stages of the Competency Continuum have been obtained taking into account the results of the Delphi process.

In the final list of outcomes (Tables 3.7, 3.8, 3.9):

- the “Team approach” outcome was substituted by “Team role and leadership”;
- all the 16 main outcomes in section 1 with consensus from Round 1 were included;
- all the learning outcomes in section 2 with consensus from Round 1 and 2 were included;
- “Decision making” without consensus from Round 2 was included.

WHAT THE ORTHODONTIST IS ABLE TO DO	Year		
	1st	2nd	3rd
Clinical information gathering			
Interview of patient, relatives and others (child or adult)	C	P	P
Extra-oral examination	C	P	P
Intra-oral examination	C	P	P
Functional examination	C	P	P
Photographs	C	P	P
Radiographs	C	P	P
Cephalometric tracing	C	P	P
Impression taking	C	P	P
Jaw registration using facebow recordings	B	C	P
Occlusal registration with wax bite	C	P	P
Cast analysis	C	P	P
Mounting casts on an articulator	B	C	P
Diagnosis and orthodontic treatment planning			
Guiding the developing occlusion	B	C	P
Adult patient	B	C	P
Craniomandibular dysfunction patient	N	B	C
Restorative and periodontal patient	N	B	C
Orthognathic patient	N	B	C
Malocclusion and medical problem	N	B	C
Diagnose and classify common craniofacial anomalies	N	B	C
Treatment planning of common craniofacial anomalies			B
Treatment procedures			
Space maintainers	C	P	P
Removable appliance	C	P	P
Functional appliance	B	C	P
Extraoral appliance	B	C	P
Fixed appliance	B	C	P
Retention appliances (removable and fixed)	C	C	P
Occlusal splints	N	B	C
Orthodontic treatment evaluation			
Orthodontic treatment results	N	B	C
Iatrogenic effects of orthodontic treatment	B	C	C
Long term effect of orthodontic treatment	N	B	C

Table 3.7: The outcomes for the specialist orthodontist in Cardiff (a)

HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE	Year		
	1st	2nd	3rd
Patient management			
Patient referral	N	B	C
Manage appropriately all forms of orthodontic emergency	C	P	P
Patient-centred	B	C	P
Communication			
Appropriate communication skills with a range of patients and relatives	B	C	P
Appropriate communication skills with other professional colleagues	B	C	P
Appropriate communication skills with personnel	B	C	P
Appropriate communication skills with technician	B	C	P
Health promotion			
Oral health	B	C	P
Health education	C	P	P
Health and safety			
Prevention of cross-infection	B	C	P
Information handling			
Clinical records	B	C	P
Computer based technology	B	C	P
Ethical behaviour			
Main ethical principles	B	C	P
Dental ethics	C	C	P
Legislation			
Professional legislation	C	C	P
National legislation		B	C
Decision making, clinical reasoning and judgement			
Clinical reasoning	B	C	P
Creativity/resourcefulness	B	C	P
Decision making	B/C	C	C/P
Management of research			
Statistics application	N	B	B
Research and scientific methodologies	N	B	C
Application basic science			
Cell and molecular biology	B	C	P
Genetics in orthodontics	B	C	C
Craniofacial embryology	B	C	P
Somatic and craniofacial growth	B	C	P
Physiology and pathophysiology of the stomatognathic system	C	P	P
Psychology in orthodontics	B	C	P
Tooth movement and facial orthopaedics	C	P	P
Biomechanics	B	C	P
Radiology	C	P	P
Orthodontic materials	B	C	P
Aetiology of malocclusion	B	C	P
Education			B
Epidemiology in orthodontics	B	C	P

Table 3.8: The outcomes for the specialist orthodontist in Cardiff (b)

THE ORTHODONTIST AS A PROFESSIONAL	Year		
	1st	2nd	3rd
Professional development			
Critical thinking	B	C	P
Evidence based medicine	B	B	C
Undertake an audit	B	B	C
Team role and leadership	C	C	P
Keep up to date		N	B
Surgery management		N	B
Personnel management		N	B
Finance			N
Personal development			
Self-awareness	C	C	P
Self -learner	C	C	P
Personal growth	C	C	P
Self-care		N	B
Career development		N	B

Table 3.9: The outcomes for the specialist orthodontist in Cardiff (c)

In the final version of “Assessment methods appropriate at various stages of the Competency Continuum” (Table 3.10):

- the original wording of 4 items in section 3 were changed;
- all the assessment methods with consensus from the Round 1 and 2 were included;
- “Poster presentation” was moved from the Beginner to the Competent stage;
- “Examining Board” was excluded from the Novice and the Beginner stages.

Novice	Proficient
Multiple Choice Questions-True/False type	Dissertation, project
Multiple Choice Questions-Extended Matching	Patient management problems
Short Answer Questions	Case presentation
Lab practical	Peer review
Interactive examination	Logbook
Beginner	Portfolio
Multiple Choice Questions -Extended Matching	Structured Clinical Operative Test (SCOT)
Short Answer Questions	Extended Structured Clinical Operative Test (ESCORT)
Modified Essay Questions (MEQ)	Audit
Structured viva	Examining Board
Unstructured viva	Expert
Interactive examination	Self and peer-assessment (Teaching, treating patients)
Lab practical	Publications, conference papers, books
Record review	Conference presentations
Simulation	
Logbook	
Competent	
Essay	
Unstructured viva	
Structured viva	
Poster presentation	
Triple jump examination	
Structured trainer’s report	
Peer Review	
Case Presentation	
Logbook	
Portfolio	
Objective Structured Clinical Examination (OSCE)	Rational at competent level?
Video assessment	
Structured Clinical Operative Test (SCOT)	
Extended Structured Clinical Operative Test (ESCORT)	
Audit	
Examining Board	

Table 3.10: Assessment methods appropriate at various stages of the Competency Continuum

3.4 Discussion

The engagement in the Delphi process technique led to increase collaboration among staff members and to a broader consideration of the learning outcomes and assessment methods facilitating the process of curriculum alignment in Cardiff.

As a result of this first part of the project a list of “specific” learning outcomes for the specialist orthodontist in Cardiff and their appropriate assessment methods were identified.

3.4.1 Discussion of the results

The final list of outcomes for the orthodontic postgraduate students in Cardiff is organized in accordance with the three circle model to classify learning outcomes by Harden et al. (1999a). Harden (2002b) defined OBE as an approach to education in which decisions about the curriculum are driven by the outcomes the students should display by the end of the programme. Broad outcomes are clearly specified and decisions about the detailed content of the curriculum and how it is organised, the educational strategies, the teaching methods, the assessment procedures and the educational environment are made in the context of the stated outcomes.

This approach to education reflects the need to have flexibility in the curriculum that facilitates the achievement of some key aims of the Bologna process (Bologna_Declaration 1999; Bologna_Process 2009):

- student centred-learning;
- lifelong learning;
- compatibility and comparability of the higher education system in different countries of the EHEA.

Students should personalise their learning experience taking responsibility of their learning so that on graduation they might be considered independent orthodontists. In an international context the outcomes of a training programme should represent the standards common to all the countries concerned to facilitate free movement of professionals. At the same time OBE allows each country to personalize its

educational and assessment strategies to the different environments and resources available.

In the compiled list each learning outcome is associated with one stage of the students' professional growth (Novice, Beginner, Competent, Proficient, and Expert) for each year of the programme. In this way it is clear that at the end of each year students have to achieve all the stated outcomes and each of them at a certain level.

This brings some advantages in comparison to previous lists of learning outcomes/competences for a specialist orthodontist (ACTDP 1995; Clark et al. 2004):

- it introduces superior to Competent levels of the students' professional growth, as is expected in a specialty programme (Chambers 1998);
- it facilitates the evaluation of the learning outcomes using the appropriate assessment methods for each level in an integrated approach to assessment (Hager 1995).

The different assessment methods, considered appropriate to evaluate the learning outcomes at different levels of the students' professional journey, have been highlighted in this study by means of the Delphi process.

Some considerations can be made in respect to the identified methods of assessment. Firstly, it was delineated that True/False Multiple Choice Questions (T/F MCQs) can be used to assess students at the Novice stage. Despite there is poor evidence for their validity and reliability in the literature (Anderson 2004; Hancock et al. 1993; Holsgrove and Elzubeir 1998; McCoubrie 2004; Tarrant et al. 2006), MCQs are widespread for assessment at the "know" level of the Miller's Pyramid (Miller 1990) and are used in "high stakes" examinations (Fischer et al. 2005; Rogausch et al. 2010; Ware and Vik 2009).

Secondly, the responses to the items related to the competent stage confirmed that the OSCE is an appropriate assessment method for this level. Despite the fact that there is evidence of using OSCEs to assess clinical competences in dentistry (Brown

et al. 1999 ; Schoonheim-Klein et al. 2008), they are best used at the “show how” level of the Miller’ Pyramid (Chambers and Glassman 1997; Miller 1990).

Thirdly, consensus was found regarding the use of portfolio as assessment tool at the Competent and Proficient levels. This is in accordance with the literature although some studies support its early introduction at Novice and Beginner levels in order to facilitate students’ reflective skills (Driessen et al. 2003). A portfolio was not present in the curriculum of the orthodontic specialist programme in Cardiff. The results of the present study support its introduction at the postgraduate level in order to facilitate the development and assessment of generic learning outcomes such as professionalism (Friedman Ben-David et al. 2001).

Fourthly “Examining Board” was excluded from the Novice and the Beginner stages. An Examining Board consists of a group of members (e.g. a chair, internal examiners, and external examiners) that gather to judge a trainee on the basis of the evidence, which has been gathered, and sometimes discussion of the evidence with the trainee (Godfrey and Heylings 1997). The process itself is not strictly an assessment exercise; rather it is the process whereby the results of assessment are produced and reviewed. The evidence that the Examining Board may consider might be derived from any form of assessment. Comprehensive assessment is possible because of the wide range of assessed sources available and, in accordance with this study’s participant opinions, is appropriate for the competent and proficient stages.

3.4.2 Research methodology

The results highlight that the Delphi process was an effective and cheap technique to find consensus of opinions on the learning outcomes and the assessment methods for the specialist orthodontist among members of a heterogeneous panel working in the same orthodontic department in Cardiff.

The criterion for consensus used in the present study was 55% and two rounds of the Delphi process were enough to achieve a high consensus (98.4%) at the end of the process.

The final achieved consensus, which is only a little higher if compared with that of a similar study (90%) conducted by Fallon and Trevitt (Fallon and Trevitt 2006), could be partly explained by the fact that all the panellists worked in the same orthodontic department.

As with most aspects of the Delphi technique, the literature provides few clear guidelines on what criterion of consensus to set. A 75% requirement for consensus may appear robust (Keeney et al. 2006), but an obvious question is how this “cut-off point” is chosen.

High response rates can improve the credibility of a study (Beretta 1996). Ideally, a response rate of 70% is suggested by Sumsion (1998) for each round.

In the present study a high response rate was retained until the final round (77, 8% after Round 1 and 100% after Round 2) and only two consultants were lost after Round 1. The heterogeneity of the panel and the high response rate in this study ensured that the entire spectrum of opinion was determined in the Delphi process.

However the Delphi process maintained a time-consuming aspect in the present study, despite the fact that some measures had been taken in this respect:

- panellists were invited to take part in the Delphi process by means of a letter that came with the Round 1 questionnaire to save time;
- a reactive Delphi was used and the panellists were asked to react to previously prepared information in Round 1 and 2;
- the Round 2 questionnaire was prepared so that the participants received feedback regarding each item that did not meet the definition of consensus;
- reminders were sent in Round 1 and 2 to motivate the panellists.

These measures brought an increased response rate but the response time was prolonged. This problem could have been overcome by giving the panellists tighter deadlines.

The time scale for return of the questionnaire was three months in Round 1 and two months in Round 2. They were too long and probably allowed panellists' to disengage with the questionnaire. Round one was considered finished after seven months and Round 2 after four months. Round 1 lasted longer because the questionnaire was accompanied by a long explanatory part and the reminder was sent after the deadline for returning the questionnaire had passed.

Time is a critical factor in using the Delphi technique. This includes time to allow interviews to be undertaken, questionnaires to be designed, distributed, returned, analysed and re-developed for subsequent rounds. At present there are no formal, universally agreed guidelines on the use of the Delphi technique nor does any standardization of methodology exist. However Duffield (1993) reported that realistically each round of the technique can take up to 8 weeks to complete and Iqbal and Pipon-Young (2009) sustained that asking panellists to spend 30 minutes completing the questionnaire is considered reasonable.

Two weeks is a reasonable time for a questionnaire completion (Bell 2010) and the time-scales for return the questionnaires in the present study are not coherent with the literature. However there is no doubt that a Delphi study is time-consuming; McKenna (1994) took 16 months to complete his well planned and executed Delphi study with only two rounds. Researchers should consider that, while a single questionnaire provides respondents' views or opinions on an issue, a Delphi study provides a level of consensus among the respondents on the issue requiring more time.

3.4.2.1 Analysis of data

One of the measures of central tendency was used to provide a statistical summary of the panellists' view on the items. It was achieved by ranking items according to their mode. The mode is a very unstable figure and it does not take into consideration and does not express the ratings that appear less frequently (Clegg 1990). However it was not a problem in this study because the mode was used in association with a criterion

for consensus (55%), which represented the majority of scores, in order to determine consensus on each item.

All the panellists' comments were carefully considered but they were not included in the section 3.4. "Results" when reflecting the consensus already achieved by means of the ratings. In this way the results have been presented in a more schematic and clearer form.

3.4.2.2 The validity and reliability of the Delphi technique

The Delphi technique has been criticised for methodological weaknesses mainly due to poor study design rather than the method itself (Beretta 1996). The questionnaire design, the influence of researchers, the selection and the size of the panel, the response rate and the interpretation of consensus are areas that influence validity and reliability of results (Williams and Webb 1994). In this study, steps were taken to reduce some reported weaknesses whereas others were still present.

Reid (1988) talks about the benefits of the Delphi in removing interpersonal influences on consensus, conferring upon it high face validity. The concept of "Quasi-anonymity" (McKenna 1994) was applied in the present study, but the respondents might have spoken to one another during the process. However the author did not disclose panellists' responses to other panel members so that the Delphi process maintained its capacity to bring consensus of opinions of a group of persons without bias.

Criteria were specified for the selection of the panel members (Williams and Webb 1994), so that the panellists participating in the study were representative of the area of knowledge being studied and content and face validity were assumed (Goodman 1987).

The consensus was achieved following two successive rounds of the questionnaire in the present study and this had a positive effect on the concurrent validity of Delphi (Williams and Webb 1994).

Despite the fact that Delphi may score highly in terms of content, face and concurrent validity, the validity of results can be affected by the response rate and the feedback influence on the panellists (Goodman 1987; Reid 1988). Goodman (1987) states that the researcher can have influence in any of the development stages of the survey, which can have implications for validity.

In this study an effective influence of the author was particularly evident in the choice to use a “Reactive Delphi” process and in the exclusion from Round 2 of the items which had already obtained consensus in Round 1. However this led to an increase the response rate that influenced the validity of the results positively (Goodman 1987) in the present study.

The small size of the panel that helped to maintain a high response rate (Esmaily et al. 2008; Reid 1988) and its heterogeneity (Burke et al. 2009; Moore 1987) brought a positive effect on the validity of the results.

Williams and Webb (1994) affirm that “there is no evidence that the Delphi method is reliable, in other words if the same information is given to two or more panels there is no guarantee that the same results would be obtained”. Furthermore they say that in some studies, investigators put a personal interpretation upon the level of consensus, often limiting the description of its value to the word “high”. They continue saying that the outcomes of such studies are open to criticism because it would be difficult to repeat the enquiry and compare consensus levels.

The criterion for consensus was specified both in Round 1 and 2 conferring more reliability to the Delphi method used (Williams and Webb 1994). In Round 1 it was arbitrarily specified only after the data had been analysed, whereas in Round 2 the criterion for consensus was set before the data had been analysed ensuring more validity of the Delphi process.

Chapter 4 Orthodontic e-portfolio development

4.1 Introduction

The introduction of an e-portfolio with a reflective component is needed in the orthodontic specialist training in Cardiff because of the presence of generic learning outcomes in the curriculum, such as personal and professional development. The success of e-portfolios as a learning and assessment tools depends on different factors (Tartwijk and Driessen 2009). They have been already used in different branches of health education, such as nursing, medicine and dentistry, but this has led to some acceptability issues (Davis et al. 2009; Driessen et al. 2007b; Duque et al. 2006; Gardner and Aleksejuniene 2008; Garrett and Jackson 2006; Kjaer et al. 2006; Pee et al. 2000; Ranson et al. 2007).

The purpose of the study was to highlight students' and supervisors' feelings about a reflective e-portfolio instituted in the postgraduate orthodontic programme at Cardiff dental hospital.

The objectives of this second part of the project were:

- to develop a portfolio that met the requirements of the postgraduate orthodontic programme in Cardiff;
- to implement it in the postgraduate orthodontic programme in Cardiff;
- to collect students' and supervisors' perceptions of the instituted portfolio regarding 1) their understanding of the portfolio, 2) the design of the implemented portfolio, 3) the utility of the learning outcomes in student learning and development, 4) the role of technology and the PDA on students' reflection in practice and on the gap between academic life and the workplace and 5) the impact of the portfolio on students' reflective learning.

4.2 Method and Materials

4.2.1 Introduction

An “Evaluation research” approach was applied to address the above cited objectives. It involved the portfolio implementation, evaluation and modification (Joyce 2005). A questionnaire was used to collect data and was analysed both qualitatively and quantitatively.

4.2.2 The orthodontic e-portfolio implementation

A portfolio, named the “Orthodontic Portfolio”, was developed to meet the requirements of the postgraduate orthodontic programme in Cardiff. Its purpose was to:

- facilitate personal reflection in practice (Driessen et al. 2005a; Driessen et al. 2003; Maidment et al. 2006a, b);
- stimulate student-centred learning and lifelong learning (Jasper 1995);
- assess students’ reflective ability (Friedman Ben-David et al. 2001; Ker 2002);
- record (McMullan et al. 2003) and assess students’ personal and professional development (Ellis et al. 2006; Friedman Ben-David et al. 2001; Gordon 2003).

In order to achieve the above purposes the in-house portfolio had a reflective component (PDP) and was structured on the learning outcomes of the orthodontic programme. The learning outcomes, obtained in the first part of this research, were used as a guide for construction of the orthodontic portfolio.

Given the advantages provided by technology (Gomez 2002) and the exponential growth of its use in health care, the portfolio in Cardiff was electronic (Orthodontic e-portfolio). A Personal Digital Assistant (PDA) seemed a logical and powerful tool to support the mobile use of the orthodontic e-portfolios in the clinical learning environment (Centre_for_Excellence_in_Teaching_and_Learning 2005).

4.2.2.1 Principles for the orthodontic e-portfolio development

The orthodontic e-portfolio was implemented taking into consideration its purposes (learning and assessment), local possibilities and a literature search carried out firstly by using “portfolio” and “education” as key words and then refined by adding “learning”, “reflection”, “assessment”, “personal development planning”, “healthcare”, “dentistry” and “electronic”. The search in the literature (Pubmed, Medline, The Higher Education Academy, Centre for Recording Achievement - CRA-, The Quality Assurance Agency for Higher Education, The UK GRAD Programme, The National Postgraduate Committee -NPC- and International Society for Technology in Education -ISTE-) led to the following list of principles that worked as a guide for the orthodontic e-portfolio development:

- a structured typology of portfolio contents: Evidence, Annotation, Critical reflection, Structure, Index and Mapping (Baume 2001);
- evidence is everything the institution and you consider as relevant to demonstrate the achievements of the learning outcomes (Hinett 2002a);
- in addition to the structure determined by the course/programme, individual learners can create their own folders in the portfolio where they can add a range of objects (Cotterill et al. 2005);
- learners can control access to specific parts of their portfolio: public and private portfolio (Baume 2001);
- the key policy for implementing the e-PDP are the general requirements for PDP in Higher Education (Quality_Assurance_Agency 2001);
- the advantages of an e-portfolio are (Gomez 2002): portability, flexibility of location and content, restricted access to material, easy management of the content, easy updating;
- students' and supervisors' enthusiasm are important in the success of the portfolio. Enthusiasm is proportional to the information that they receive about the process (O'Sullivan et al. 2002);
- Race (2002) defines reflection in this way: “The act of reflecting is one which causes us to make sense of what we have learned, why we learned it, and how the particular increment of learning took place. Moreover, reflection is about

linking one increment of learning to the wider perspective of learning-heading towards seeing the bigger picture”;

- a number of models have been devised to illustrate cycles of reflection (Boud et al. 1985; Dewey 1933; Gibbs 1998; Kolb 1984; Moon 1999; Schön 1983);
- real and challenging reflection requires a trainer or a tutor (Snadden and Thomas 1998b);
- training on reflection is needed for tutors and students (King 2002; Moon 2001);
- portfolios must balance reflection components with structured evaluation components (Carraccio and Englander 2004);
- portfolios provide an assessment solution for a curriculum based on OBE (Davis et al. 2001; Friedman Ben-David et al. 2001);
- portfolios can be used for both formative and summative assessment (Driessen et al. 2005a; Mathers et al. 1999);
- portfolios allow assessment of students’ competence (Gadbury-Amyot et al. 2003; McMullan et al. 2003);
- portfolios fit the triangulation approaches in assessment in which not one method but rather a combination of assessment methods can capture the complexity of professional competences (McKimm 2001; Tartwijk and Driessen 2009);
- portfolios provides authentic assessment of performance over a period of time (Snadden and Thomas 1998a);
- portfolios provide an assessment of outcomes such as professionalism and reflective ability (Davis et al. 2001; Friedman Ben-David et al. 2001);
- both reflection process and product should be assessed in a portfolio (Moon 1999);
- portfolios allow learners to take an active role in the assessment process (Hinett 2002a). Engaging students in self-assessment helps students to understand what make up quality, to develop evaluative skills and to monitor their progress (Hinett 2002a);
- implementation of portfolio for formal assessment incorporates a sequence of steps: defining the purpose, determining competences to be assessed, selection of portfolio material, developing a marking system, selection and

training of examiners, planning the examination process, student orientation, developing guidelines for decisions, establishing reliability and validity of evidence, designing evaluation procedures (Friedman Ben-David et al. 2001).

Furthermore, a table that highlights the different stages in portfolio development by Challis (1999) was used as a guide for the orthodontic e-portfolio creation.

4.2.2.2 The IT component of the orthodontic e-portfolio

The orthodontic portfolio was a web-based electronic utility, which facilitated the recording, editing, searching and analysis of portfolio data, and allowed learners and supervisors to share data among them easily. Further technology was supposed to allow an improvement in the portfolio's impact on learning, professional development and assessment (Chang 2001; Duque et al. 2006).

Despite the fact that many dedicated portfolio systems were available and user-friendly, the e-portfolio in this study was developed using standard software. The reasons for this choice were the cost of dedicated portfolio software, the desirability of a good interface with Blackboard (Blackboard Academic Suite- Version 6, Blackboard Inc.), the internet platform already present in Cardiff University, and the low specificity of the portfolio's format and content obtained with these dedicated tools. Furthermore, this decision would make future maintenance and changes of the orthodontic portfolio easier. "Microsoft Word" and "Microsoft Excel" were used because they offered a good interface with Blackboard and its internet facilities (Figure 4.1).

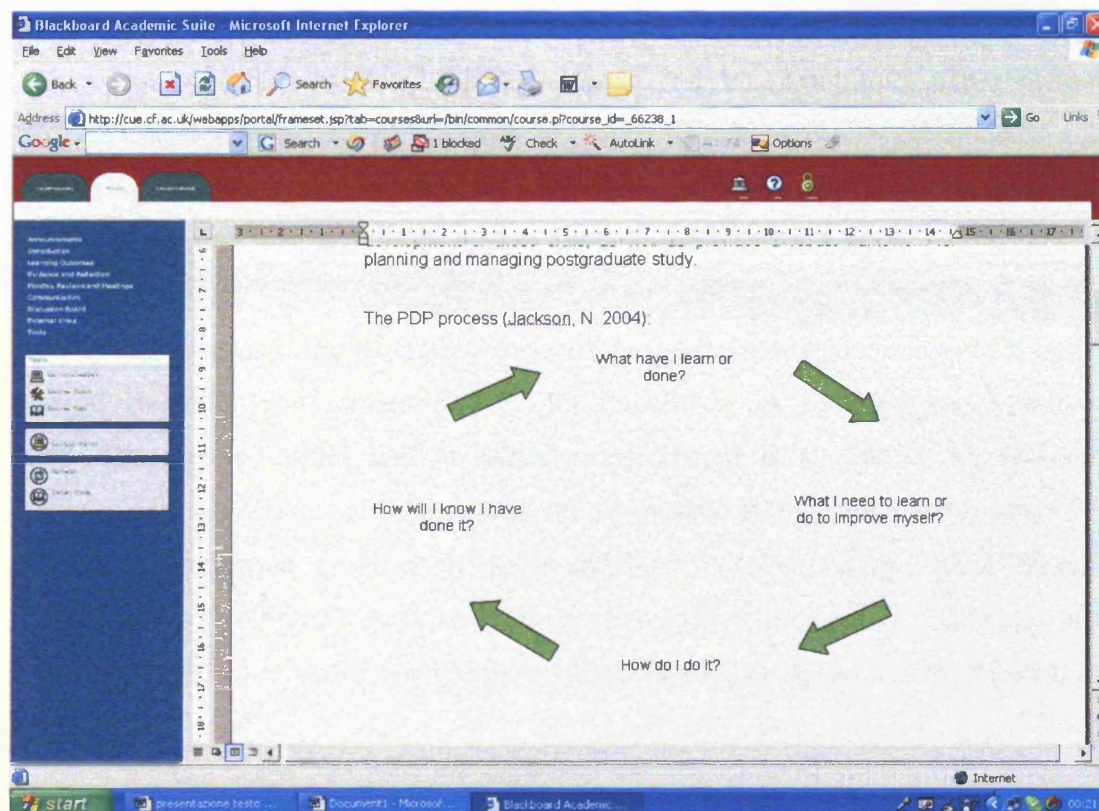


Figure 4.1: A page of the orthodontic e-portfolio on Blackboard

The orthodontic e-portfolios consisted of a series of students' reflective compilations, accomplishments, and presentations, and feedback of meetings with mentors, which were stored electronically on Blackboard and on students' and supervisors' PCs. The entries were in the form of text (Excel sheets, Word document and PDF), pictures, x-rays and photographs.

The flexibility of the web based orthodontic e-portfolios gave the following benefits:

- evidence could be collected in many types of media (audio, video, graphics, text) (Gomez 2002);
- evidence was well organized and could be retrieved for different purposes (Gomez 2002);
- restricting access to material in the e-portfolios was relatively easy (Gomez 2002). In Blackboard, the files that made up the orthodontic portfolio were password protected and students and supervisors could see different parts of a portfolio using different passwords (private and public parts);

- the electronic medium enabled sharing and exchange of information through Internet browsing functions that would not be possible in paper format (Driessen et al. 2007a; Kjaer et al. 2006). Blackboard allowed students and supervisors to access and edit portfolios easily and to discuss with one another by means of tools such as email and discussion boards.

A PDA was also used in this study after considering the many advantages of it in the clinical learning environment (Centre_for_Excellence_in_Teaching_and_Learning 2005; Kjaer et al. 2006) and in orthodontics (Hirani et al. 2005). An accurate evaluation of the different PDAs present on the market, taking into consideration the characteristics needed for the study, led to the decision to buy an hp iPAQ PDA and an hp iPAQ “foldable” keyboard (Figures 4.2). The innovative Teaching and Learning fund from Cardiff University allowed buying the PDAs and the “foldable” keyboards.



Figure 4.2: PDA and “foldable” keyboard

The PDA was used as a wireless and internet-connected clinical learning tool (Garrett and Jackson 2006) designed to promote:

- students’ reflection improving clinical learning (forms, stored in the PDA, to record of experiences and reflection);
- the application of academic knowledge to the workplace (browsing documents saved in the PDA or websites);

- the interaction, during clinical practice, with other students or supervisors (access to email and discussion board).

The Microsoft Windows Mobile Pocket PC platform was used to create a mobile orthodontic e-portfolio. The PDA could be synchronized with a PC in order to allow the updating of the orthodontic portfolio stored in the PC with the mobile one.

Taking into consideration Hauge's (2006) study which showed evidence that users' technical ability and knowledge significantly affect how they interacted with an e-portfolio, a training session on the use of the orthodontic e-portfolio, Blackboard and the PDA was arranged before the beginning of the pilot.

4.2.2.3 Framework of the orthodontic e-portfolio

The orthodontic e-portfolio was organised into learning outcomes (Driessen et al. 2003). This was helpful for supervisors to indicate what material in the portfolio was supposed to be shown and where to find it. It also helped students to organize the evidence in their portfolio into sections corresponding to the different learning outcomes to be assessed, and used captions to explain what the evidence showed about a specific learning outcome (Tartwijk and Driessen 2009).

The learning outcomes used for the orthodontic e-portfolio development were those for which consensus was found in the first part of this research. The outcomes had to be achieved by students at a certain level at the end of each year of the programme. There were five different levels from Novice to Expert that represented the criteria to use for judging students' progression and achievement of learning outcomes during the programme.

4.2.2.4 Components of the orthodontic e-portfolio

In the orthodontic e-portfolio on Blackboard there was an introduction with appropriate guidance notes for students and supervisors involved in the pilot. There was information on the learning outcomes and the "Novice-Expert criteria", which

could be analyzed and downloaded if needed. The concepts of portfolio and reflection were explained to make the purposes of the orthodontic e-portfolio clear. A detailed description of the format and content of the orthodontic portfolio was provided with an explanation of the supervisors' and students' roles in the experience of using the e-portfolio. There were guidelines on the type and the quantity of evidence that would be considered appropriate to demonstrate learning achievement, but the students themselves had to decide what was the most appropriate and specific evidence to collect in their portfolio. A clear description of the assessment process was also present. Further to this general introduction, each section of the e-portfolio had its own guidance notes. Students and supervisors also receive an induction by means of meetings with the researcher and explanatory emails before the experience with the portfolio.

The e-portfolio involved student selection, collection, synthesis and organization of possible relevant items to provide the best evidence of achievement of learning outcomes, justifying selected items with reference to the outcomes.

There were two main parts in the orthodontic portfolio called "Requirements" and "Personal Folder" (Cotterill et al. 2005), where students collected evidence following the intended indications by the institution for the first, and from their own personal thinking for the latter.

There were different specific forms (Every day clinical records, Essays/Exam records, Records of clinical activities, Records of presentations, Records of MSc meetings, Case presentation, Involvement in research or Audit, Records of courses and conferences attended, Records of publications, Records of awards, prizes and grants) in "Requirements" and "Personal Folder" that students compiled and then linked to the specific learning outcomes.

Students supplemented the evidence in the forms with appropriate reflection to explain why each piece of evidence had been included. The use of reflective logs in the e-portfolio encouraged students to develop the habit of open and honest deep reflection (Hinett 2002a).

The structured and supported use of reflection enabled students to plan their personal, educational and career development by means of the PDP component of the orthodontic e-portfolio (Carraccio and Englander 2004; Hinett 2002a). That

component was intended to stimulate and encourage the habits of students centred-learning and lifelong learning that enabled students to provide the highest standards of care for their patients as well as on-going satisfaction in their chosen career (Hinett 2002a).

The reflective process is personal and students could decide whether to share it or not. Some sections of the portfolio were intended to be “Private” in order to encourage honest reflection (Baume 2003); however learning achievements, needs and issues could be recorded and brought to the attention of the personal supervisors.

Supervisors had an important role in supporting students during portfolio building and the PDP process (Driessen et al. 2003; Snadden and Thomas 1998b).

In this study each student had two supervisors, an academic and a clinical one, as suggested by David et al. (2001). The academic supervisors facilitated students in their PDP and progress through monthly formal meetings, along with other informal meetings arranged as and when required. Clinical supervisors were more involved in helping students to collect evidence and reflect in a clinical setting.

Training was implemented for both the academic and clinical supervisors (O’Sullivan et al. 2002).

The orthodontic e-portfolio served as a tool for both formative and summative assessments.

Information such as the nature and amount of students’ academic and clinical work undertaken and feedback from personal supervisors relating to students’ knowledge, clinical skills and attitude could all be recorded in the portfolio. Appropriate forms were devised in the e-portfolio to show the progress with students’ studies, what they had attempted to achieve, and how far they had met the learning outcomes of the programme.

The orthodontic e-portfolio also served as a tool for assessing in a summative way personal and professional development learning outcomes (Friedman Ben-David et al. 2001; Gordon 2003). This was carried out through the assessment of students’ reflective abilities because reflective practice encourages the key features of professional and personal development learning outcomes: self-awareness, self-learning and self-care (Friedman Ben-David et al. 2001).

4.2.2.5 The orthodontic e-portfolio content and structure

The following flowchart describes the different steps in students' orthodontic e-portfolio building (Figure 4.3).

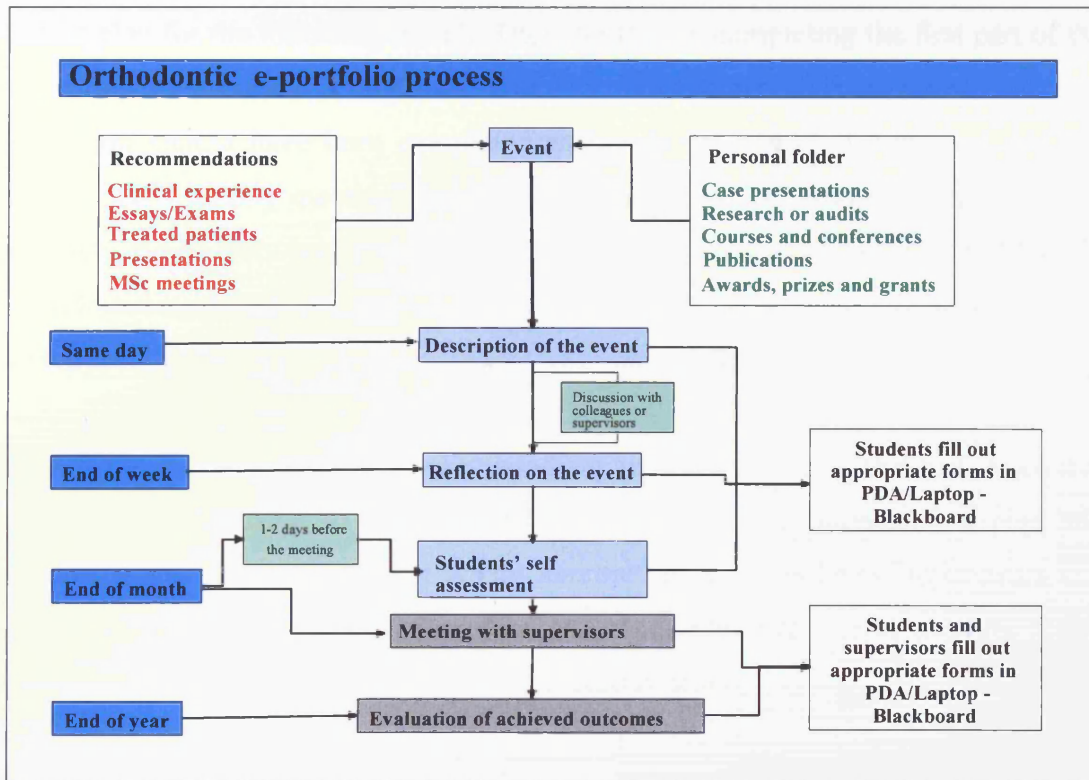


Figure 4.3: Steps of the orthodontic e-portfolio process

The orthodontic e-portfolio process was based on the existence of learning outcomes that should have been achieved during the three year postgraduate orthodontic programme.

Students recorded and described events (evidence) and linked these to the appropriate learning outcomes the same day that those happened. They completed the appropriate forms on the PDA or on their laptop. In each case, students' notes should allow them to better describe the event at a later date.

At the end of the week, students critically reflected on the evidence they had recorded and completed the reflection part of the forms into the PDA or on their laptop. Subsequently the forms should be saved in Blackboard. They could be saved

in the “Private” or “Public” portfolio section. Supervisors were just allowed to read the forms present in the public folder.

At the end of the month, students, taking into consideration the evidence collected in that period, self-assessed their progress towards the learning outcomes and created an action plan for the following month. They did this by completing the first part of the “Monthly review and meeting form” and then uploaded it onto Blackboard.

The form should have been completed and ready on Blackboard at least one day before the “Monthly meeting” between the student and the academic supervisor. In this way supervisors had a chance to read the completed first part of the “Monthly review and meeting form” to check the evidence collected for that month, and further to think about the issues students might raise at the meeting.

During the meeting, supervisors discussed any learning outcomes that had arisen that month, gave feedback to students, helped them with the future action plan and identified and arranged training where appropriate. On this basis, supervisors and students completed the second part of the “Monthly review and meeting form” together. They also decided the date for the next meeting.

The Monthly review and meeting represented the PDP component of the orthodontic e-portfolio. During the PDP process students gathered the appropriate evidence of learning progress, reviewed and reflected on their current level of learning in comparison to expected learning outcomes and identified areas for future development. On doing so, students transformed prior knowledge and skills into a foundation for further growth and learning (McMullan et al. 2003). The ultimate goal of the process was that students would become more selective and self-directed in providing evidence of their learning development and achievement of outcomes, and would demonstrate how they had developed personally and professionally and where further learning was needed (McMullan et al. 2003).

At the end of each year the two supervisors could evaluate their own student’s progress towards all the learning outcomes. The content of the orthodontic e-portfolio included summaries of students’ progress towards the learning outcomes, in

the form of “Monthly review and meeting forms”, and a variety of evidence that confirmed the progress.

Furthermore supervisors, taking into consideration the results of other assessment methods carried out during the year, could assign a level to each learning outcome in the “Learning outcomes assessment table” using the “Novice-Expert assessment criteria”, both downloaded from Blackboard. Students who presented deficiencies would be referred for further remedial work.

4.2.2.6 The reflective component of the orthodontic e-portfolio

Reflection helps students to develop deep learning (Hinett 2002a; Mathers et al. 1999; Moon 2001) because it helps to clarify and make sense of what has been learned and locate it within an individual framework. Such reflection can enable students to critically review their own actions, to identify patterns, resolve uncertainties and formulate a plan of action for the future in the best interest of the patient (Hinett 2002a; King 2002). Reflection is equally useful when learning has been unsuccessful; indeed in such cases, reflection can often give insights into what may have gone wrong with learning, and how on a future occasion now-known pitfalls might be avoided.

The expression of reflection, verbally or in written form, and the associated techniques such as self and peer-assessment help students to develop and use a bank of skills such as: self-awareness, confidence, motivation and interpersonal skills, personal and professional skills (Gordon 2003; Mathers et al. 1999; Wald et al. 2009; Wessel and Larin 2006). These encourage the habit of student-centred learning and lifelong learning that are two fundamental components of professional education.

Different factors, important in allowing a reflective process, have been introduced in the present experience with the orthodontic e-portfolio:

- writing up a portfolio (Maidment et al. 2006a, b);
- tutoring (Wald et al. 2009);

- structure and guidelines of the portfolio (Driessen et al. 2005a; Driessen et al. 2003);
- information on “how” to reflect (Cole 2005b);
- teaching staff engagement in the process of reflection (Hinett 2002b).

Students reflected by writing weekly in the e-portfolio, so that information about events was still fresh in the mind, and through monthly discussion with supervisors. The e-portfolio was designed to provide a framework within which students could reflect on clinical and academic experiences in a structured way. The reflective sections were structured following the model of reflection in Figure 4.4 that is a modified version of the Gibbs’ (1998) cycle of reflection.

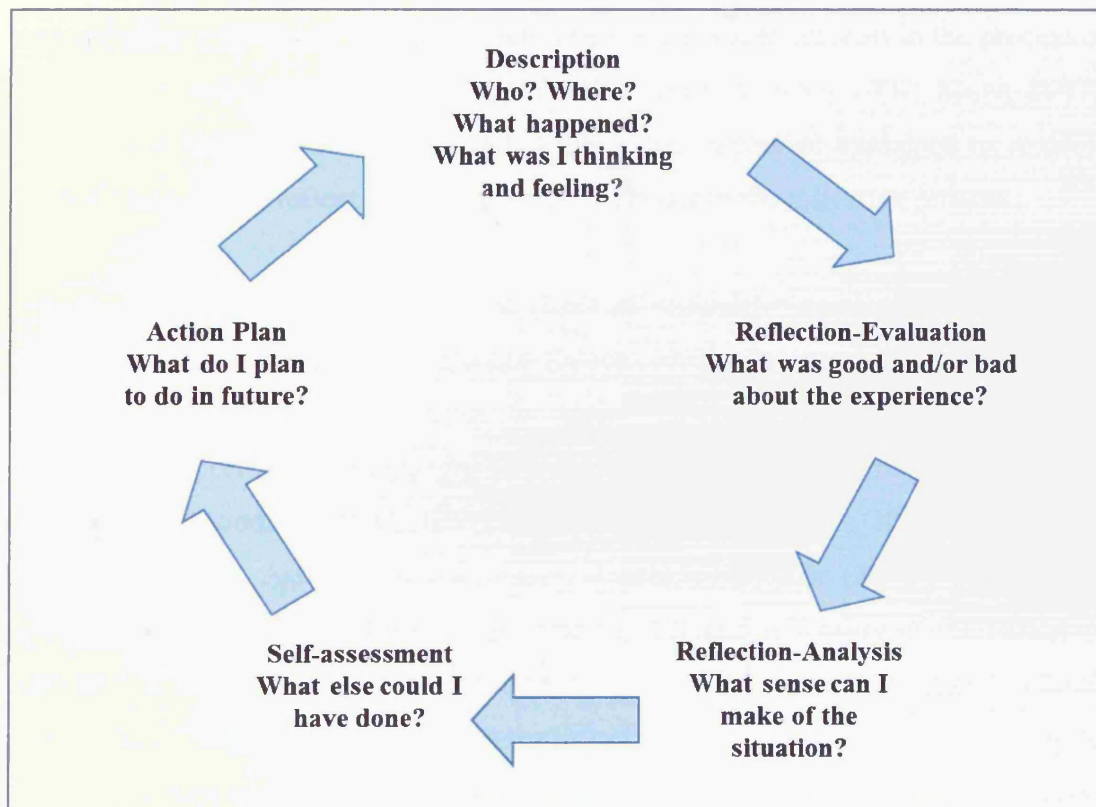


Figure 4.4: Modified Gibbs’ (1998) cycle of reflection

Students were asked to reflect on an experience (Kolb 1984) going through all the stages of the cycle. That way of understanding reflection was simplistic in relation to that proposed by Dewey (1933) but it was needed because reflection was a new concept for most of the orthodontic students in Cardiff. In the orthodontic e-portfolio

reflection was considered part of the learning process (Moon 1999), it included feeling, values and attitudes (Boud et al. 1985) and was highly context specific (Boud and Walker 1998). Reflection-in-action (Schön 1983), which is the most complex and demanding kind of reflection, and reflection-for-action (Cowan 1998) were also introduced to students and supervisors.

It is difficult to teach reflection in the traditional way (Race 2002). Questions can be provided to students as devices to help them both to reflect and to highlight their reflection (Race 2002). Each reflective section of the portfolio was provided with a list of specific questions that have been formulated using the examples in Race's (2002) article. Reflection can be superficial and little more than descriptive, or can be deep and involved in the transformative stage of learning (Moon 2001). Verbal instruction, examples and exercises should be used to guide students in the process of reflection in order to improve their reflective abilities (King 2002; Moon 2007). Therefore, a meeting was also organized where the researcher explained to students the basic concept of reflection and the steps to follow in the reflective process.

Despite contrasting opinions about the effect of summative assessment of reflective abilities on students' reflection practice (Moon 2002b; Pee et al. 2002; Richardson and Maltby 1995), an instrument to assess reflection was introduced in the orthodontic e-portfolio. Among the different models to describe the different levels of reflection (Goodman 1984; Ker 2002; Mezirow 1991; Moon 2001; Wong et al. 1995), the PDRA Assessment Instrument, developed by Ker (2002), was used to assess reflective abilities in this study. The validity and reliability of the PDRA in assessing reflection were demonstrated by Ker et al. (2003) and Burnett et al. (2008) respectively. The marking system and the criteria to assess reflection described in the orthodontic e-portfolio and principally derived from Ker (2002) are shown in Table 4.1.

Level 1: Links relevant experience to specific outcomes
Student is able to describe relevant experiences, to link and summarize them in relation to the outcomes of the course.
Level 2: Evaluates relevant experience as evidence of progress
Student is able to analyse and evaluate relevant experiences which provide evidence of their progress towards the outcomes of the course.
Level 3: Identifies and re-evaluates own learning needs
Student is able to re-evaluate their progress in learning in relation to the outcomes, taking into account their experiences in different clinical settings. They are able to identify, on the basis of their experience, their own learning needs and plan for future action.

Table 4.1: The three levels of reflective ability by Ker (2002)

4.2.2.7 The assessment component of the orthodontic e-portfolio

The implementation of the orthodontic e-portfolio assessment had incorporated a sequence of steps as suggested by Friedman Ben-David (Friedman Ben-David et al. 2001).

Used formatively, the orthodontic e-portfolio could enable the needs and strengths of students to be identified, the acquisition of the learning outcomes to be monitored and the progress of students to be continuously assessed. Regular meetings between students and academic supervisors and the relationship between students and clinical supervisors in practice were tools used for formative assessment.

The orthodontic e-portfolio was also structured to be used in a summative way in the future. Used in a summative way, it could allow the assessment of personal and professional development learning outcomes by means of the evaluation of students' progress and reflective abilities (Ker 2002) ("Reflective evaluation component"), and supplement the assessment of the other learning outcomes that are usually measured by other methods of assessment ("Structured evaluation component").

Because of the student-centred nature of the portfolio, the summative assessment process was personalized and criterion-referenced to support its validity (Friedman Ben-David et al. 2001). The literature review of Driessen et al. (2007b) reported some crucially important factors to increase reliability of portfolio summative assessment: small groups of trained assessors, specific assessor training exercises, assessor discussion (before and during the assessment procedure) and the use of holistic scoring rubrics (global performance descriptions).

In the “Reflective evaluation component”, students’ reflective abilities were assessed by only one trained examiner (Kember et al. 1999; Sumsion and Fleet 1996), who judged reflection in writing and discussion using the marking scheme and criteria developed and present in the orthodontic e-portfolio (PRDA) (see Table 4.1).

In the “Structured evaluation component”, which was not evaluated in the present project, the criteria (Friedman Ben-David et al. 2001) used for assessment were the list of the learning outcomes of the programme associated with the appropriate levels from Novice to Expert. The evidence collected was evaluated following the intended indications by the institution. The assessment contained quantitative and qualitative judgements to generate a more comprehensive interpretation of students’ achievement. Two trained supervisors were involved in the assessment process; they analysed the different parts of the orthodontic e-portfolio, discussed between them and agreed on an holistic evaluation of the portfolio (Driessen et al. 2007a; Friedman Ben-David et al. 2001). External examiners were not included in the process because of the lack of familiarity with the educational programme and students’ progression (Friedman Ben-David et al. 2001).

Supervisors’ training sections on the orthodontic e-portfolio assessment were considered necessary to support reliability (Friedman Ben-David et al. 2001). Training sections for students, where they were instructed on the outcomes, the assessment criteria and the assessment process (Baume 2003), were also needed.

4.2.3 The orthodontic e-portfolio experience

The orthodontic e-portfolio was piloted in the MScD (Master of Science Degree) orthodontic programme in Cardiff. Members of staff were selected as clinical or academic supervisors of the orthodontic e-portfolio. Students, clinical and academic supervisors received an invitation letter in July 2006. All the subjects asked to take part to the study agreed to participate and signed a consent form.

There was an induction period to introduce the orthodontic e-portfolio to students and supervisors. Two seminars about how to use Blackboard and the PDA and the interface between these two electronic tools were scheduled for the students. Another introductory seminar was organized for students where they received information on the concept of portfolios and reflection, the structure and the content of the orthodontic e-portfolio, where to find it in Blackboard and how to use it, and the names of the academic and clinical supervisors involved in the pilot study and the respective students. Academic and clinical supervisors received similar information during only one seminar.

Each student was given a PDA pre-loaded and configured with the portfolio software. The students compiled the orthodontic e-portfolio for the first two months of their second year of training (September-October 2006). Clinical supervisors helped students to use the e-portfolio day by day and the academic supervisors met the students at the beginning of October 2006 in the “Monthly meeting” for formative assessment.

Following the two-month period, data were collected through questionnaires (November 2006). A quantitative and qualitative analysis of the questionnaires allowed students’ and supervisors’ perceptions on the experience of using the e-portfolio to be highlighted.

4.2.4 The study sample

The sample consisted of:

- the 2006/2007 second year of the MScD programme in orthodontics in Cardiff. These were six postgraduate students, two males and four females;

- seven members of the staff of the orthodontic programme in Cardiff, who were recruited as supervisors.

4.2.5 Research design

An “Evaluation research” approach (Patton 2002a) was chosen to study the orthodontic e-portfolio implementation. It was used in a formative way in this pilot study. The author worked with students and supervisors in order to understand the good and bad aspects of the e-portfolio introduced in the orthodontic programme at Cardiff and improve it without the attempt to generalize the findings to other situations (Grbich 1999a; Patton 2002c).

4.2.6 Data collection

Data were collected from two questionnaires, one for students and one for supervisors, developed by the author. Questionnaires were distributed at the end of the pilot using Blackboard and students and supervisors were asked to complete and return them within one week. Students and supervisors were asked to rate a number of statements on a Likert-type six-point scale from 6-very strongly disagree to 1-very strongly agree and comments were also requested. The students’ and supervisors’ questionnaires contained thirty-one and sixteen statements respectively.

4.2.7 Ethical consideration

4.2.7.1 Ethical approval

Ethical approval for this part of the research was granted by the Medical Dental School Research Ethics Committee (MDSREC).

4.2.7.2 Informed consent

Participants were free to decide if they wanted to take part in the study. In order to encourage participation invitations were sent personally by the author (Appendix XIII) and not by a programme organiser but no rewards were offered to those taking part in the study. The author issued all the participants suitable for inclusion in the study an information sheet approved by MDSREC (Appendix IX). It provided potential participants with full information about the nature and the purpose of the research, how it would be conducted, how they had been chosen to participate and what they should do in the study and the consequences of the research. It also assured participants of the fundamental ethical principles of anonymity and confidentiality, of the fact that their participation would have no impact on the grades awarded or relationships with the institution, of their right to decline in answering any question, and to withdraw from the study at any time without giving a reason and without prejudice or penalty. All the participants who had agreed to take part in the study were asked to sign a consent form that confirmed that they had been informed and were willing to take part (Appendix X).

4.2.8 Data entry and storage

The questionnaires were analysed quantitatively and qualitatively. The quantitative data were collected using a Microsoft Excel document and the comments were collected using a Microsoft Word document. To conform to the Data Protection Act, the quantitative data and the comments from students and supervisors were anonymous and participants' confidentiality was ensured using unique subject ID codes to identify participants.

4.2.9 Quantitative analysis

In this pilot, five aspects of the orthodontic e-portfolio were analysed quantitatively:

- the orthodontic e-portfolio concept;
- the orthodontic e-portfolio structure;

- the 16 main learning outcomes of the programme;
- the use of technology in building the orthodontic e-portfolio;
- the orthodontic e-portfolio's impact on learning.

Each statement present in the students' and supervisors' questionnaires was associated to one of the above aspects (Table 4.2).

Orthodontic e-portfolio aspects and questionnaire statements
The orthodontic e-portfolio concept
A) I have positive feelings towards the e-portfolio. (Su&St)
A1) Building the e-portfolio is a useful learning experience. (Su&St)
A2) The e-portfolio could be used as a summative assessment at the end of each year of the programme. (Su&St)
The orthodontic e-portfolio structure
B) Instructions given in the e-portfolio modules on Blackboard are clear. (Su&St)
B1) The e-portfolio design is concise and logically organized. (Su&St)
B2) The number of e-portfolio forms is appropriate. (St)
B3) Patterns of entries of the e-portfolio forms are logical and easy to follow. (St)
B4) The process of saving the recorded information on PC and then in Blackboard is clear and quick. (St)
B5) The carrying out of a meeting every month is not needed and too time-consuming. (Su&St)
B6) I would have liked more advance information about building the e-portfolio. (Su&St)
B7) The information in Blackboard is sufficient and I feel confident in assessing the reflective skills of students. (Su)
The 16 main learning outcomes of the programme
C) I had a good understanding of the 16 main outcomes. (Su&St)
C1) The definition of the 16 main outcomes helped me/students with the direction in self-learning. (Su&St)
C2) The process of linking events to main outcomes was clear. (St)
C3) Building the e-portfolio helped me to achieve the 16 main outcomes through my daily work. (St)
C4) Building the e-portfolio made me think in broad terms about my professional development as defined by the 16 main outcomes. (St)
C5) Recording of evidence using the e-portfolio forms is not sufficient to demonstrate achievement of the 16 main outcomes. Other forms of evidence (audio, video etc.) could be useful. (Su&St)
The use of technology in building the orthodontic e-portfolio
D) The e-portfolio is more flexible than a paper portfolio. (Su&St)
D1) The IT component of the e-portfolio process is too complex. (Su&St)
D2) The PDA can be used easily in clinic. (St)
D3) The PDA can be taken easily to another institution. (St)
D4) The Bluetooth "foldable" keyboard is easy to use and transport. (St)
D5) Blackboard is an appropriate and quick tool to share information with supervisors and colleagues. (Su&St)
The orthodontic e-portfolio impact on learning
E) I/students developed the e-portfolio in accordance to the institution guidelines. The final product demonstrated my/their organizational skills and creativity. (Su&St)
E1) The reflective writing process helped me to grasp my learning process. (St)
E2) The monthly review was a useful tool for self-assessing and summarising my strengths and weaknesses. (St)
E3) Supervisor feedback helped me to reflect on my strengths and weaknesses in learning. (St)
E4) The feedback from peers helped me to reflect on my strengths and weaknesses in learning. (St)
E5) Compiling the e-portfolio helped me to increase communication and exchanges with my supervisors and my peers. (St)
E6) Building the e-portfolio gave me a sense of achievement. (St)
E7) Building the e-portfolio was very time-consuming and interfered with my academic and clinical work. (St)
E8) The monthly meetings with the supervisor were a useful tool for formative assessment. I/students could get feedback on my/their reflective skills from my/their supervisor. (Su&St)
*(Su&St): supervisors' and students' statement; (Su): Supervisors' statement; (St): Students' statement.

Table 4.2: Statements associated to each orthodontic e-portfolio aspect

The agreement with each statement was measured on an interval scale from 6-very strongly disagree to 1-very strongly agree. Descriptive statistics was used to explore the frequency distributions with regards to different statements present in the questionnaire.

4.2.10 Qualitative analysis

The comments of students and supervisors collected with the questionnaires were considered useful for such purposes as providing a deeper exploration of students' and supervisors' views, suggesting new hypotheses, and possibly cross-validating quantitative findings. They were analysed in a qualitative way by means of a content analysis (Taylor-Powell and Renner 2003).

4.2.10.1 The qualitative analysis process

The comments collected with the questionnaires were typed in a Microsoft Word document. An identification (ID) was assigned to each respondent, and each comment was associated with the ID of the respondent that wrote the comment. The comments were organized by questionnaire statements and by groups (supervisors and students) to look across all respondents and their answers in order to identify consistency or differences. Then the author read through the text to identify significant themes. The themes were tagged with codes, which were inserted in the text using a different font colour (Figure 4.5).

The use of technology in building the orthodontic e-portfolio (P&IT*)

D2) The PDA can be used easily in clinic**

J*** PDA is not user friendly in clinic for big spread sheets (unfriendly) and am afraid it might be stolen or lost from clinical unit, another piece of expensive equipment to keep track off (compact)

E Yes in theory it can be used easily in clinic but I prefer note certain events on paper and transfer to the PDA after clinic at the end of the day/week as no time on clinic to fill it out (no time)

S There is not usually sufficient time to fill the PDA in clinic (no time)

I PDA is too time consuming (time-consuming)

H Although I could, I preferred to fill the PDA after clinic, as what with notes to write, appointments to make, audit forms to fill I find just I do not have time (no time)

IT PDA is not very stable on the foldable keyboard (unstable)

D3) The PDA can be taken easily to another institution

J PDA is small, neat, easy to carry, but easily nicked (compact)

S PDA can be taken to another institution because it is compact (compact)

IT PDA is too small for the large excel spreadsheets (unfriendly)

*: Category code

**: Statement code

***: Respondent code

Figure 4.5: Themes identification and data labelling

The next step was to organize the themes into categories. The categories were previously identified with codes. They represented the five aspects of the orthodontic e-portfolio used in the quantitative analysis. Once the categories had been identified in the text and the data labelled with the category codes, grouping the data into categories was done using the cut and paste function. All the texts representing a category were saved in a Microsoft Excel sheet that included a column for ID, themes code and text (Figure 4.6).

ID	Theme codes	Citations
J	PDA unfriendly	PDA is not user friendly in clinic for big spread sheets
K	PDA no time	I prefer note certain events on paper and transfer to the PDA after clinic as no time on clinic to fill it out
L	PDA no time	There is not usually sufficient time to fill the PDA in clinic
M	PDA time-consuming	PDA is too time consuming
N	PDA no time	Although I could, I preferred to fill the PDA after clinic, as what with notes to write, appointments to make, audit forms to fill I find just I do not have time
O	PDA unstable	PDA is not very stable on the foldable keyboard
P	PDA compact	PDA small, easy to carry, but easily picked but am afraid it might be stolen from clinical unit, another piece of expensive equipment to keep track off
Q	PDA compact	PDA can be taken to another institution because it is compact
R	PDA unfriendly	PDA is too small for the large excel spreadsheets
S	FK* use and transportation	FK is easy to transport but not very easy to use
T	FK use and transportation	FK is easy to transport but not to used
U	FK use and transportation	FK is not too small
V	FK use and transportation	FK is easy to transport but it is not easy to connect to the PDA using Bluetooth and the batteries run down too quickly
W	BB** friendly	BB can be uploaded for everyone to read and is easily accessible
X	BB friendly	BB is an appropriate and quick tool to share information with supervisors and colleagues
Y	BB friendly	Email and discussion board in BB are good tools for communication
Z	FK* Foldable Keyboard	
AA	BB** Blackboard	

Figure 4.6: Screen shot of Excel sheet of the category: “The use of technology in building the orthodontic e-portfolio”.

After this, the author analysed the frequency that a theme occurred to identify patterns, the presence of exceptions that did not seem to fit, and the connection between themes and categories.

As a result of the data categorization, the author developed a list of findings. A final report was then written to communicate the results, where citations from the text were used to illustrate and validate the findings.

4.3 Results

4.3.1 Response rate and missing data

A total of 11 (84.6%) of the 13 questionnaires were returned. Responses were received from 100% (6/6) of students whereas 71.4% (5/7) of the supervisors replied. Conversely the questionnaires from the supervisors were better completed, with less missing answers compared with those compiled by students (Table 4.3).

Questions	Missing data from students % (n)	Missing data from supervisors % (n)
Recording of evidence using the e-portfolio forms is not sufficient to demonstrate achievement of the 16 main outcomes. Other forms of evidence (audio, video etc.) could be useful.	16.7 (1)	
I/students developed the e-portfolio in accordance to the institution guidelines. The final product demonstrated my/their organizational skills and creativity.	33.3 (2)	16.7 (2)
The monthly review was a useful tool for self-assessing and summarising my strengths and weaknesses.	16.7 (1)	
Supervisor feedback helped me to reflect on my strengths and weaknesses in learning.	33.3 (2)	
The feedback from peers helped me to reflect on my strengths and weaknesses in learning.	16.7 (1)	
The monthly meetings with the supervisor were a useful tool for formative assessment. I/students could get feedback on my/their reflective skills from my/their supervisor.	16.7 (1)	

Table 4.3: Missing replies to some questions in the returned questionnaires

4.3.2 Quantitative analysis

The agreement of students and supervisors with each statement in the questionnaire was measured on an interval scale from 6-very strongly disagree to 1-very strongly agree. Each level of the interval scale (VSD, SD, D, VSA, SA, A) is represented with a colour (Figure 4.7). A group data analysis allowed highlighting of the total agreement and the total disagreement with the questionnaire positive statements about the e-portfolio experience. The blue colour represents total agreement (Σ - AGREE including VSA, SA, A) and the red total disagreement (Σ - DISAGREE including VSD, SD, D) (Figure 4.7).

The tables 4.4, 4.5 summarise the score obtained for each questionnaire statement from students and supervisors (frequency distributions). The quantitative analysis of data showed that supervisors had more positive support for the e-portfolio compared with students that expressed more reservations.

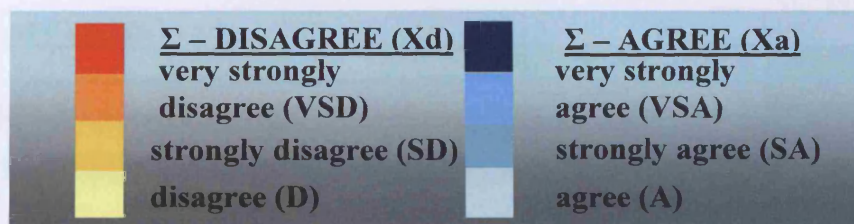


Figure 4.7: Legend

SUPERVISORS	VSD	SD	D	A	SA	VSA	Xd	Xa
A	0	0	1	2	2	0	1	4
A1	0	0	1	1	3	0	1	4
A2	0	0	2	2	1	0	2	3
B	0	0	2	2	1	0	2	3
B1	0	0	3	0	2	0	3	2
B5	0	0	1	1	3	0	1	4
B6	0	1	1	0	2	1	2	3
B7	0	1	3	1	0	0	4	1
C	0	0	0	2	3	0	0	5
C1	0	0	1	2	0	2	1	4
C5	0	0	0	1	4	0	0	5
D	0	0	0	4	1	0	0	5
D1	0	1	2	2	0	0	3	2
D5	0	0	0	3	2	0	0	5
E	0	0	0	3	1	0	0	4
E8	0	0	1	1	1	2	1	4

Table 4.4: Supervisors' scores assigned to each statement in the questionnaires

STUDENTS	VSD	SD	D	A	SA	VSA	Xd	Xa
A	1	0	2	2	0	1	3	3
A1	1	0	2	2	0	1	3	3
A2	2	0	2	1	0	0	4	1
B	0	0	2	3	1	0	2	4
B1	2	3	0	1	0	0	5	1
B2	2	0	2	2	0	0	4	2
B3	1	0	3	2	0	0	4	2
B4	1	1	1	2	1	0	3	3
B5	1	0	1	0	0	3	2	3
B6	1	3	2	0	0	0	6	0
C	1	0	1	2	2	0	2	4
C1	0	0	1	1	3	0	1	4
C2	0	1	1	2	2	0	2	4
C3	1	0	2	1	1	0	3	2
C4	0	1	3	1	0	0	4	1
C5	2	1	0	1	0	0	3	1
D	2	0	1	1	1	1	3	3
D1	0	2	1	2	0	1	3	3
D2	3	0	2	0	1	0	5	1
D3	0	0	0	0	2	4	0	6
D4	2	0	2	1	0	0	4	1
D5	1	0	0	0	3	2	1	5
E	0	1	0	1	1	0	1	2
E1	0	3	1	0	0	1	4	1
E2	0	0	2	1	1	0	2	2
E3	0	0	2	0	1	0	2	1
E4	0	1	3	0	0	0	4	0
E5	1	3	0	1	0	0	4	1
E6	1	2	1	0	1	0	4	1
E7	0	0	1	0	3	1	1	4
E8	0	1	2	0	1	0	3	1

Table 4.5: Students' scores assigned to each statement in the questionnaires

4.3.3 Qualitative analysis

The frequency of distribution of the scores for each statement, together with a qualitative analysis of the comments associated with each statement in the questionnaires, made it possible to individualise students' and supervisors' opinions on the five aspects of the orthodontic e-portfolio previously considered.

4.3.3.1 The orthodontic e-portfolio concept

Three of the students had positive feelings towards the e-portfolio and thought it was a useful learning experience. However the majority could not see how the building of a portfolio could be a useful learning experience. They commented about some of the purposes of the e-portfolio like:

“Keeping a record for CPD”;

“I think the idea of an e-portfolio is good - it would let you have an electronic portfolio of your entire three years’ worth of training - in theory this could then be easily accessed, presented to others and useful for updating things like your CV”.

Only one of the students commented that the portfolio:

“.... permits to reflect on the experience”.

Four of the students thought that the e-portfolio could not be used as a summative assessment and this is shown by the comment:

“I believe people would be careful of what they put in the portfolio if that was the case”.

Four supervisors had positive feelings towards the e-portfolio and they thought that building the e-portfolio was a useful learning experience. However the importance of reflection in the learning process was not completely clear as shown in this comment on the portfolio:

“Some aspects I feel positive about, but not others - in particular the self-reflection”.

Three supervisors thought that the e-portfolio could be used for a summative assessment but:

“Only after a long lead-in to gain experience in using it as an assessment tool”.

4.3.3.2 The orthodontic e-portfolio structure

The orthodontic e-portfolio stored in Blackboard contained information on the concept of reflection and its assessment and instructions about how to compile the portfolio itself. Four students thought that the information and instructions were clear

and informative and all of them affirmed that they did not need more advanced instructions about building the e-portfolio.

On the other hand, despite the fact that three of the supervisors thought that the information and instructions given in the e-portfolio in Blackboard were clear, four of them affirmed that they were not sufficient and they did not personally feel confident in assessing the reflective skills of students. This was expressed by a comment:

"It is a steep learning curve and probably needs more support than we realise".

Five of the students thought that the e-portfolio design was not concise and well organized as expressed in these citations:

"Not concise, not suitable for PDA as very difficult to read and enter on spread-sheets on such a small screen. Best view of sheets to fill is on laptop, then calling up spread-sheets on a full PC screen";

"As you input data you have to create a new file for a new entry - in a year you may have hundreds of files which would be difficult to view in summary - I think a database application would be a better way of putting in the data".

Four students affirmed that the process was time-consuming because there were too many e-portfolio forms with patterns of entries which were not logical and easy to follow. This was also expressed by the following comments:

"Some of the entries are obscure and repetitive";

"Sometimes I think there are too many - reflection/what I need to do next-boxes- some entries are very simple- sometimes I think I need to write something in the boxes just to -fill the gap-";

"It is a very time consuming process, would be better to have the possibility to click on options and reduce the amount of typing involved..."

However three students affirmed that once the forms were compiled, the process of saving the recorded information on the PC and then in Blackboard was clear but some training would be needed in order to speed up the process. A comment expressed this concept:

"I find that I become familiar with computer applications after I've carried them out a few times".

Three students thought that carrying out a meeting every month was not needed and too time-consuming and five of the students suggested that two or three meetings per

year were enough. Four supervisors agreed with students on this and two of them added that:

“Different students may need different intervals between meetings”.

4.3.3.3 The 16 main learning outcomes of the programme

Four of the students affirmed that they understood the 16 main learning outcomes and the process of linking them to the different events. The same number of students said that the definition of learning outcomes helped them with the direction in self-learning as expressed in some comments:

“They - learning outcomes - cover all aspects of a MSc programme” and “it’s a good idea to break your learning so that you have a better understanding of what are your strong areas and what areas you need to work on”.

Five of the supervisors also affirmed to have a good understanding of the learning outcomes and four of them thought that the definition of the 16 main outcomes helped students with the direction in self-learning.

Despite this, four students said that building the e-portfolio did not help them to think in broad terms about professional development and three said that it did not help to achieve the 16 main outcomes through daily learning. However a comment worth noting is:

“I had just a short experience with the e-portfolio but, thinking over a longer period of time, maybe it can help achieving the learning outcomes”.

4.3.3.4 The use of technology in building the orthodontic e-portfolio

Three of the students thought that the electronic portfolio was more flexible than a paper one but four students’ comments indicated that the IT component was time consuming. With regard to the IT component of the e-portfolio, three students seemed to cope with it but the other three felt it was too complex. In the comments, two students indicated that there were many stages involved in the process, two thought that time was needed to get used to it and one expressed the need for some formal training beforehand. This was backed up by the comment:

“Although most people should be fairly IT competent, there is a lot to take on board and I think there should have been some formal training beforehand”.

Five supervisors also felt that the electronic portfolio was more flexible than a paper version and three affirmed that the IT component of the portfolio was not too complex. However a supervisor highlighted that an e-portfolio was:

“More environmental friendly. Flexibility depends upon the way the software is written”.

Despite the fact that students affirmed that the PDA and “foldable” keyboard were small and easy to transport to another institution, the results did not show strong support for the use of them. Five supervisors and four students respectively thought that the PDA and the “foldable” keyboard could not be used easily in the clinic. Four students commented that there was not enough time in the clinic to use the PDA:

“Although I could, I preferred to fill the PDA after clinic, as what with notes to write, appointments to make, audit forms to fill I find just I do not have time”.

Furthermore, three students supported the idea that the PDA and the keyboard were not user friendly. The PDA’s small screen did not display the excel files well and the forms used to collect data on the experience, as expressed in the comment:

“PDA was not user friendly for big spread sheets..... it was much easier to use a lap/desktop.... and am afraid it might be stolen or lost from the clinical unit, another piece of expensive equipment to keep track of”. The keyboard “is not so easy to connect to the PDA using Bluetooth and the batteries run down too quickly”.

Supervisors agreed that other forms of evidence (audio, video etc.) could be useful to demonstrate the achievement of learning outcomes; on the other hand, three students thought that writing was the best way to show which learning outcomes had been achieved.

There was more support regarding the use of Blackboard; five students and five supervisors felt that it was an appropriate and quick tool to share information with supervisors and colleagues.

4.3.3.5 The orthodontic e-portfolio impact on learning.

The results did not show great support with regard to the e-portfolio impact on learning during the experience in Cardiff.

The majority of the students thought that building the e-portfolio did not give them a sense of achievement, was very time consuming and interfered with their academic and clinical learning, as expressed by this comment:

“a time consuming process at the moment, I am only beginning to become familiar with it”.

However one student suggested a solution:

“If we were given the portfolio at the start of the programme I think it would have been more beneficial - at the moment I feel the bulk of it is repetition”.

Despite this, four supervisors agreed that students could demonstrate their organizational skills and creativity in building an e-portfolio according to the institution's guidelines. Only two students felt they had obtained this and another student commented:

“Probably the institution's guidelines should be more explicit”.

Four students did not feel that compiling the e-portfolio helped them to increase communication and exchanges with their peers, but one commented:

“Not really with my peers, but maybe it is just a matter of time”.

Four students did not think that the reflective writing process helped them in their learning process and commented:

“I don't think writing it down added much to my learning...”
“The process is too detailed and time consuming”.

Most of the students affirmed:

“Time consuming to type it all out, especially when it's a daily process”.

Two students did not compile the monthly review and only two thought it was a useful tool for self-assessing and summarising their strengths and weaknesses. Three

students did not have the meeting with the supervisor or did not get feedback, and among those that met with their supervisors only one agreed that supervisor feedback in the meeting helped him/her to reflect on their learning strengths and weaknesses. In addition, two students commented:

“If you have some topics of discussion you can probably get useful feedback from the supervisor - but after some meetings”;
“....however I think than more than one meeting is needed to get this effect”.

Finally four supervisors and only one student agreed that the monthly meeting with the supervisor was a useful tool for formative assessment of reflective skills.

4.3.4 Summing up and conclusion

The results of this pilot have been summarized in Figure 4.8. Each e-portfolio aspect is represented by a series of different coloured boxes and the red boxes are the negative cases within each aspect.

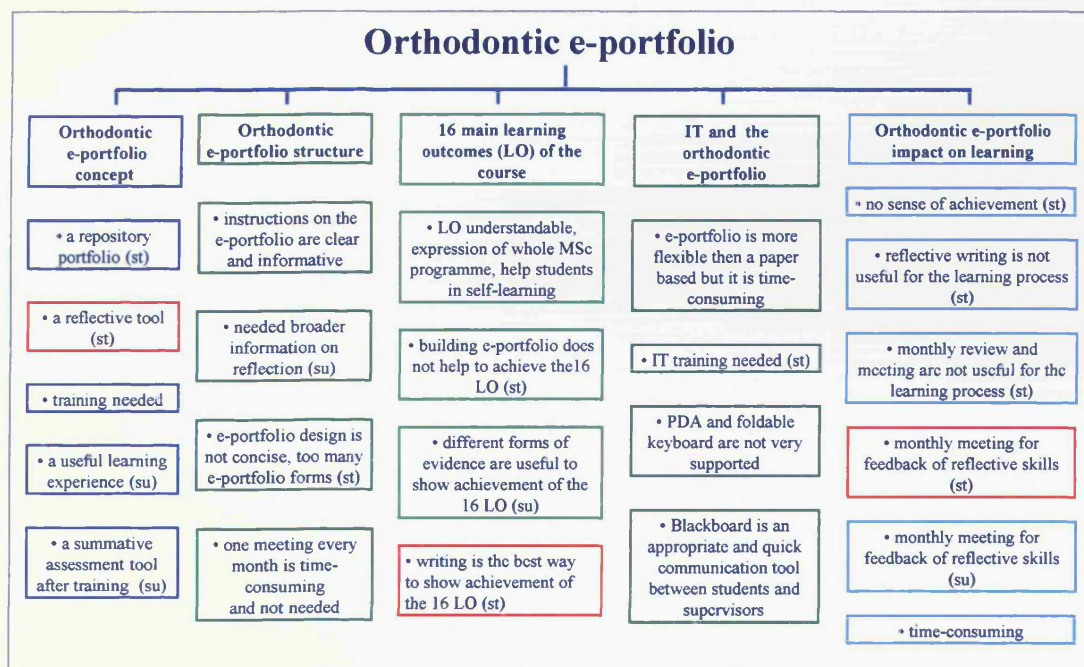


Figure 4.8: Summary of the first pilot results (st: students, su: supervisors)

These results, obtained from a quantitative and qualitative analysis of the data, highlight that students' and supervisors' opinions collected through questionnaires

showed the necessity to make some changes to the Orthodontic e-portfolio. The changes needed to improve the orthodontic e-portfolio are listed below:

- broader information on reflection, learning process and assessment of reflective skills;
- need of a longer pilot period;
- careful briefing of supervisors and students to increase motivation;
- simplification of e-portfolio forms to collect evidence;
- use of a database to organize the evidence recorded;
- reduction of the frequency of meetings;
- use of different ways to collect evidence (audio, video);
- more prior IT training;
- different use of PDA and “foldable” keyboard.

4.4 Discussion

Both the quantitative and the qualitative analysis of the results showed that there were students’ and supervisors’ concerns about technical difficulties and time management during the experience. The orthodontic e-portfolio was better accepted by supervisors than by students as a learning and assessment tool. These findings, which confirm the results of previous studies, were probably partly related to the students’ and supervisors’ little familiarity with the concept of reflection and the building of an e-portfolio (Davis et al. 2009; Ellis et al. 2006; Gardner and Aleksejuniene 2008; Kjaer et al. 2006; Snadden et al. 1996), to the structure of the orthodontic e-portfolio and to the short, two-month pilot study.

The introduction of an e-portfolio as a tool to stimulate and assess reflection in a study programme required time, change in the portfolio structure, training and continuous support that are possible only in a context where the concept of reflection is completely understood and accepted and the will of changing is present (Davis et al. 2001).

Davis et al. (2009) showed that the initial difficulties and time management related to the introduction of a reflective portfolio as a tool for assessment disappeared with

time if there is a real will of the institution to accept it and make the needed changes in the study programme for its implementation.

4.4.1 Discussion of the results

4.4.1.1 The orthodontic portfolio purposes: learning and assessment

The portfolio is considered a useful learning tool because it encourages adult and self-directed learning and addresses the problem of a widening gap between thought and action in a complex practice setting (Gardner and Aleksejuniene 2008; Snadden and Thomas 1998b). Students' opinions about the e-portfolio in the present study showed that it did not achieve its potential in encouraging and enhancing students learning. On the other hand supervisors described the orthodontic e-portfolio as a positive learning tool.

The orthodontic e-portfolio was structured around the 16 outcomes, for which consensus to be applied in the postgraduate orthodontic programme in Cardiff was achieved in the first part of this project. The majority of students and supervisors agreed in the questionnaire that the learning outcomes in the e-portfolio were well defined, covered all the aspects of the orthodontic programme in Cardiff and helped students with direction in learning, as shown by this comment made by a student:

"It's a good idea to break your learning so that you have a better understanding of what are your strong areas and what areas you need to work on".

The high students' and supervisors' understanding of the learning outcomes in the present study could be explained, as in Davis et al. (2009), by the fact that the students had to build up the e-portfolio around these outcomes and they considered the process of linking evidence to the learning outcomes clear.

However students in the present study affirmed that building the e-portfolio did not help them to achieve the learning outcomes. They explained that using the portfolio did not give them a sense of achievement.

Students did not experience the last phases of the PDP process (development of a theory, the formulation of a plan of action) as happened in Gordon's (2003) study

where the portfolio helped students to achieve personal and professional development learning outcomes.

The communication among students did not seem to have increased, as previously shown by Chang (2001), and a student commented:

“Not really with my classmates, but maybe it is just a matter of time”.

Two factors that played a negative role in the relationship between portfolio and learning were the length of the pilot and the period of the orthodontic programme in which the e-portfolio was introduced.

Students used the orthodontic e-portfolio for only two months at the beginning of the second year of the programme and probably had insufficient time to familiarize themselves with it. One of the students highlighted this fact with the comment:

“I had just a short experience with the e-portfolio but thinking of a longer period of time, maybe it can help achieving the learning outcomes”.

Another student commented:

“If we were given the portfolio at the start of the programme I think it would have been more beneficial - at the moment I feel the bulk of it is repetition”.

Snadden and Thomas (1998b) and Gardner and Aleksejuniene (2008) highlighted how important reflection and mentoring were for the positive impact of the portfolio on learning.

Students described the orthodontic e-portfolio as a file containing materials collected by students during the programme and used as records of Continuing Professional Development and for Curriculum Vitae building. Most of the students in the present study did not mention the fact that the orthodontic e-portfolio could be a useful tool for developing reflective skills and only one of them commented that the e-portfolio:

“.... permits to reflect on the experience”.

Four students did not think that the writing process in the portfolio helped them to grasp and reflect on their learning process and commented:

“I don’t think writing it down added much to my learning...”.

Only one of the students, the same that described the orthodontic portfolio as a tool to facilitate reflection on the experience, affirmed that the supervisor’s feedback in

the meeting helped in their reflection on merits and shortcomings in learning. Some other students commented that more than one meeting with supervisors would be necessary to stimulate students' reflection.

The negative students' opinions regarding the e-portfolio impact on reflection seem partly related to the fact that the pilot study was short. As confirmation of this, the interaction with the portfolio lasted for at least one year in previous studies (Driessen et al. 2003; Maidment et al. 2006a, b) where reflective writing and mentoring were considered effective tools in the portfolio for stimulating reflection in medicine and dentistry. Furthermore Grant et al. (2003) confirmed, evaluating students' responses in two consecutive years, the positive impact of experience and training on the capacity of a medical student learning journal to facilitate reflection.

Driessen et al. (2005a) discussed the effectiveness of the portfolio in stimulating reflective skills by analysing the views of experienced medical teachers (mentors), obtained in semi-structured interviews. They described portfolio guidelines, coaching and summative assessment of reflection as conditions for successful reflective use of portfolios.

Four supervisors and only one student in the present study agreed that the monthly meeting (coaching) was a useful tool to provide students with feedback on their reflective abilities.

Furthermore the scarce students' knowledge of the e-portfolio and of the reflection process and the lack of a summative assessment of reflection has probably influenced students' views on the ability of a portfolio to stimulate reflection.

Gordon (2003) used the portfolio and an interview as summative assessment tools to evaluate students' personal and professional development at the Faculty of Medicine at the University of Sydney, and obtained the consensus of most students that gave their opinion on the experience through a questionnaire. If the orthodontic e-portfolio was helpful for evaluating the learning outcomes of personal and professional development, it could be inserted as a part of the final degree examination at the end of the three year orthodontic programme. For this reason students and supervisors were asked about it in the questionnaire.

Students and supervisors had different opinions on the use of the orthodontic e-portfolio as a summative assessment tool. Supervisors thought that the portfolio could be used as summative assessment, but only after a period of training that allows students and supervisors to understand exactly the dynamics of the assessment process and the criteria used as previously supported by teachers in Driessen et al. (2005a). On the other hand four students did not believe in the authenticity of the evidence collected in the portfolio if this was used as a summative assessment tool and one commented:

“I believe people would be careful of what they put in the portfolio if that was the case”.

In the present study students’ opinions sustain the formative-summative conflict of portfolio assessment, as in an article by Snadden et al. (1996), where participants perceived some doubts regarding the usability of portfolios as a summative assessment tool without interfering with the goal of stimulating and supporting reflective learning. However, in the study of Snadden et al. (1996), those perceptions were not sustained by any differences in portfolio content. A similar result has been obtained by Kjaer et al. (2006), showing that 71% of e-portfolio users feared they would be less honest and avoid showing shortcomings, if their notes were used for assessment purposes. Kjaer et al. (2006) recommended that a part of the portfolio should be kept exclusively for formative feedback and Barrett (2007) explained as an e-portfolio could facilitate this division.

4.4.1.2 The orthodontic portfolio structure

The orthodontic e-portfolio was introduced and explained to students and supervisors by means of an explanatory email, meetings with the researcher and written information present in the introduction of Blackboard.

Students were happy regarding the instructions on the portfolio and the information on reflection received but their answers to the statements in the questionnaire regarding the effect of a portfolio on reflection and learning highlighted the need for more information. Supervisors affirmed the instructions and information received were not sufficient and in particular they needed more support in the assessment of

reflection because they explained that assessing reflection was a steep learning curve. Previous studies have shown as continuous guidance on portfolio building, reflection and assessment were important factors for the success of the experience with the portfolio (Davis et al. 2009; O'Sullivan et al. 2002).

The mentor is considered an important guide for students in building the portfolio (Davis et al. 2009). Students and supervisors in the present study recognized the importance of the supervisor's role in the portfolio building, but the number of meetings with the supervisor was considered excessive and time consuming. They suggested two/three formal meetings per year, with the possibility for students to meet supervisors informally if needed.

Students felt that building the orthodontic e-portfolio was time consuming and interfered with their academic and clinical learning, as found in previous studies (Davis et al. 2009; Gardner and Aleksejuniene 2008). They liked the questions helping them to complete the portfolio instead of logging events in a more open format. However they added that a lot of writing was required because too many forms were needed to collect evidence in the e-portfolio and the patterns of data entry were repetitive and without "drop down" list.

Davis et al. (2009) concluded that paperwork should be kept within manageable limits, as suggested by most of the students in the present study. One student commented that it was:

"Time consuming to type it all out, especially when it's a daily process".

4.4.1.3 The IT component of the orthodontic portfolio

The present study, unlike previous ones (Driessen et al. 2007a; Kjaer et al. 2006), includes both the trainees and trainers' perspective regarding the use of an e-portfolio instead of a paper one. Three students and five supervisors considered the electronic portfolio more flexible than a paper one. However it is necessary to say some of them did not have a real experience with a paper portfolio.

This student's comment on the orthodontic e-portfolio:

“Although most people should be fairly IT competent, there is a lot to take on board and I think there should have been some formal training beforehand”

expresses three important variables that should be considered in the development of an e-portfolio:

- complexity of the system;
- information technology (IT) competence;
- training needed.

Three students thought that the IT component of the orthodontic e-portfolio was too complex because Microsoft Word and Excel did not offer immediate and simple hyperlink functionality and there were too many stages involved in the process. This represents one of the disadvantages associated with e-portfolios (Tartwijk and Driessen 2009): an e-portfolio requires a stable and high quality information technology infrastructure that is not always available. The version of Blackboard (Blackboard Academic Suite- Version 6, Blackboard Inc.) present at Cardiff University in that period did not allow other software to be used to create the orthodontic e-portfolio and to modify the portfolio directly online. Each participant in the study had to download the orthodontic e-portfolio, change it and then upload it again onto Blackboard.

Another disadvantage associated with e-portfolios (Tartwijk and Driessen 2009) is that e-portfolios can only be successfully used by learners and teachers who are sufficiently skilled in using the relevant software and hardware. Basic IT training was carried out for students and supervisors in Cardiff before the experience, according to the fact that IT training is likely to be a requirement when implementing an e-portfolio system (Duque et al. 2006; Hauge 2006). However, the author overestimated the IT abilities of students and supervisors in this study, and a more specific and individual IT training should have been provided.

The IT component of the orthodontic e-portfolio was considered time consuming by the majority of the students probably because the software used was not the most appropriate and their IT abilities were insufficient.

Each student was provided with a PDA and a “foldable” keyboard and received training on how to use these tools. The objectives of this study were to evaluate the potential of the PDA as a tool to promote reflective learning in practice and prevent the isolation of students whilst engaged in the clinic.

Students’ opinions on the capabilities of a PDA as a tool to support the mobile use of a portfolio in the clinical environment were previously collected and evaluated by means of questionnaires and interviews in nursing (Garrett and Jackson 2006) and medicine (Ranson et al. 2007). Ranson et al. (2007) explained that although resources were made available in a PDA format, the students’ IT skills and the amount of text to type represented barriers to the use of a PDA in a clinical environment. He proposed that a web-based PDA might provide greater functionality and ease of use for students. Garrett and Jackson (2006) evaluated the use of a networked PDA in clinic and highlighted very similar issues, such as the interface limitations, students’ technical skills, clinical workload and the amount of typing.

In the present study the PDA was used to allow students to compile the portfolio forms during clinic, describe and reflect on different events, and communicate by means of the internet. Students did not show great support for the use of the PDA and the “foldable” keyboard. They thought these tools were small and easy to transport but they did not use them in the clinic within current structures due to the clinical workload and the time required for the process to be completed. A student commented:

“Although I could, I preferred to fill the PDA after clinic, as what with notes to write, appointments to make, audit forms to fill I find just I do not have time”.

PDA’s were not considered appropriate to compile the “Microsoft Excel” forms used in the orthodontic e-portfolio. The handwriting user interface put the students off entering data; the screen was seen as too small for the “Microsoft Excel” forms requiring too much time to enter data. The use of the “foldable” keyboard was an option proposed to type quickly but students demonstrated a preference for not entering text using this tool.

A student commented that the keyboard:

“Is not so easy to connect to the PDA using Bluetooth and the batteries run down too quickly”.

Supervisors agreed that alternative forms to writing, such as audio or video, could be useful to collect evidence. Students could record audio information and reflections on events in clinic easily and quickly using the PDA (Centre_for_Excellence_in_Teaching_and_Learning 2005). However students did not think this was a possible option to reduce the amount of typing, probably because they already had many things to cope with and could not accept anything new.

Once the forms were compiled, the process of saving them into a PC and then on Blackboard was considered clear and easy, but time consuming. Most of the students preferred to use a desktop computer to compile the forms, as shown by Garrett and Jackson (2006).

Students cited other barriers already cited by Ranson et al. (2007), such as the possibility to lose the PDA or the “foldable” keyboard and the limited memory of the PDA.

A more individualized and on-going training programme on the handheld equipment and its applications, taking into consideration students’ existing skills, and a reduction in the amount of typing needed could lead to a more positive response to the use of a PDA in clinic.

Students responded positively to the PDA as a tool that allowed them to surf the internet during clinic. Blackboard also received support by students and supervisors. It is considered an appropriate and quick communication tool to share information between students and supervisors.

4.4.2 Research methodology

The main benefits of using an “Evaluation research” approach (Patton 2002a) in the present study were a deeper understanding of the orthodontic e-portfolio strengths

and weaknesses and the other factors that influence the success of its introduction for the postgraduate programme in orthodontics at Cardiff in the future.

The author of this study was one of the students attending the pilot. This facilitated the honest compilation of the questionnaires by students and there was only a small risk of introducing bias because the researcher did not have any particular interest in applying the orthodontic e-portfolio in the postgraduate programme at Cardiff. Honesty in answering the questionnaires was also encouraged by assuring students that their participation would have no impact on the grades awarded or relationships with the institution and also emphasising data confidentiality.

Students and supervisors, chosen though a “purposive sampling” technique (Patton 1990), were able to give opinions and impressions on the effectiveness of the orthodontic e-portfolio after using it for two months. However the short pilot influenced students’ and supervisors’ opinions on the experience with the portfolio. The sample was small but the possibility of applied the results to a different population was not an aim of this research study (Bower and Scambler 2007).

Semi-structured questionnaires with statements were presented and participants were asked to respond by means of a Likert scale and to make comments. This provided the opportunity to generate numbers, which were analysed in a quantitative way (Cohen and Manion 1989). It also allowed respondents to comment in their own terms and capture the specificity of a particular situation (Cohen and Manion 1989). Data from the literature related to e-portfolio development were used to formulate the questionnaire statements (Barrett 2003; Chang 2001; Gadbury-Amyot et al. 2003). The questionnaire was designed following the practical considerations highlighted by Cohen and Manion (1989). A supervisor and two students of the previous year in the programme, who did not take part in this study, read the questionnaire statements to evaluate if they were well written and eliminate the problems related to the language barrier. However a reliability test for the questionnaire statements was not performed.

Students’ and supervisors’ answers to the questionnaire statements generated frequencies of response amenable to analysis (Cohen and Manion 1989). The data

were categorical and a non-parametric test was considered. Even considering the answers that represented agreement to a statement (4-5-6 of the Likert scale) as a group and the answers that represented disagreement (1-2-3 of the Likert scale) as a second group, the frequencies were too small and no statistical test could be applied. Two tables were a better way to show the frequencies of students and supervisors' agreement to each questionnaire statement and compare this between the two groups.

Qualitative and quantitative methods were combined in this study in order to achieve a deeper understanding of the data collected. The patterns of frequency for each statement were also expressed together with the comments in the qualitative description of the results. A detailed description of the qualitative research design and data analysis applied, together with source triangulation (Patton 1999), the highlighting of the negative cases and the use of citations in the description of the results helped to assure an accurate interpretation of the data collected in this study (Barbour 2001).

The categories in the qualitative analysis were pre-set instead of emerging from the data analysed because the problems related to the application of an e-portfolio to a group of students and supervisors were previously treated in the literature even if in fields different than orthodontics. In this "Evaluation research" study the author investigated five aspects of the orthodontic e-portfolio, represented by the pre-set categories, considered important for its improvement in the postgraduate orthodontic programme in Cardiff.

4.5 The modified orthodontic e-portfolio

The orthodontic e-portfolio was modified on the basis of the students' and supervisors' opinions resulting from the first pilot study in order to be evaluated in a longer pilot study forming the third part of this project.

The modified orthodontic e-portfolio was basically structured into three main stages (Figure 4.9):

- students recorded relevant events and tasks in the portfolio, associated them to the learning outcomes and reflected on them;
- every 3 months, students summarised and discussed the events/tasks and the associated written reflections in the “PDP review and meeting”. They were also judged on their reflective abilities during the “PDP meeting”;
- the previous two stages facilitated a summative assessment of learning outcomes achieved by the end of the year.

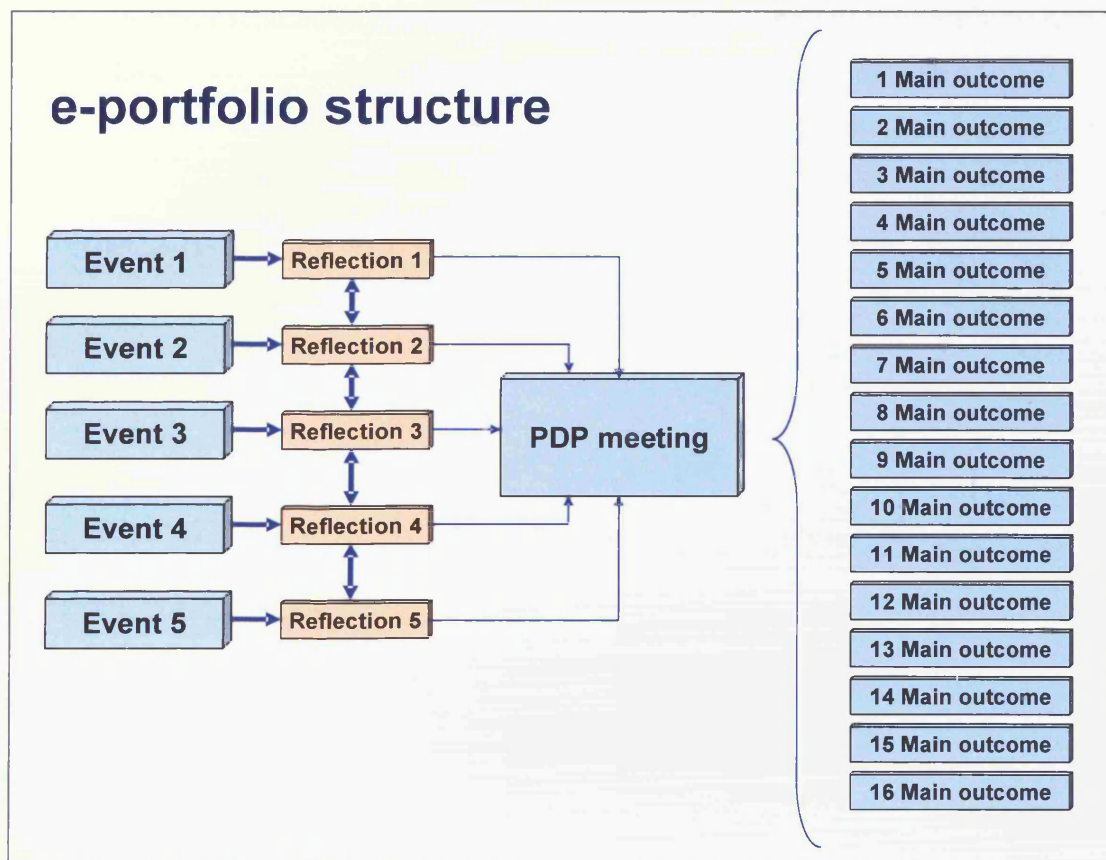


Figure 4.9: The modified orthodontic e-portfolio structure

Students and supervisors had criticised that the e-portfolio, which was implemented using “Microsoft Word” and “Microsoft Excel”, did not offer immediate and simple hyperlink functionality. A new version of Blackboard (Blackboard Academic Suite-Version 8, Blackboard Inc.), which incorporated the use of “Microsoft Access”, was made available for the modified portfolio. This allowed creating a portfolio as a database that was accessible via the Blackboard on-line resource. The database

permitted easier and quicker hyperlinks and speeded up the execution of the three main stages of the orthodontic e-portfolio.

Students also commented that the e-portfolio could not be used for reflection and assessment at the same time because if they were to be judged they did not feel free to reflect sincerely. The revised orthodontic e-portfolio was better able to balance the need of the institution for an assessment management system with the need of the learners for a reflective portfolio that supported deep learning. The concept of portfolio assessment was better explained to students (Moon, 2001) and the database allowed a better separation between the private and public part of the portfolio (Kjaer et al. 2006).

The database was password protected and there was a private area for personal reflection (Figure 4.10, area 1). The academic and clinical supervisors had permission to look at students' e-portfolios through Blackboard except for the section of the database that was personal.

The database allowed students to record different events and tasks using a range of forms (Figure 4.10, area 2).

Student details
Name: 1
Address: 1
e-mail: 1
Password: 1
Year of MSc Course: 1

Orthodontic Portfolio
giovedì 18 ottobre 2007

OUTCOMES

EVERY EVENT

Reflection log

Private Reflection log

Assessment records

Clinical observation
Essay
Exam

360° Appraisal

Burce
Patient
Receptionist
Technician
Undergraduate

Records of clinical activity

Presentations

MSc presentation
Case presentation
Teaching presentation

Research records

Audit
Ethical approval
Journal club

Personal folder

Courses / Conferences
Publication / Presentation / Article
Awards / Prizes / Grants

Meeting records

PDP review
PDP meeting

CV

Figure 4.10: The opening page of the database (1-2)

Each form was simplified following students' suggestions from the first pilot. The forms allowed students to describe an event or task, attach files related to it, associate it to one or more main outcomes and reflect on it (Figure 4.11).

OUTCOMES

WHAT THE ORTHODONTIST IS ABLE TO DO

HOW THE ORTHODONTIST APPROACHES PRACTICE

THE ORTHODONTIST AS A PROFESSIONAL

Main outcomes

- Clinical information gathering
- Diagnosis and orthodontic treatment planning
- Treatment procedures
- Orthodontic treatment evaluation
- Patient management
- Communication
- Health promotion
- Health and safety
- Information handling
- Ethical behaviour
- Legislation
- Decision making clinical reasoning and judgment
- Management of research
- Application basic science
- Professional development
- Personal development

Learning outcomes

- Interview of patient, relatives and others (child or adult)
- Extra-oral examination
- Intra-oral examination
- Functional examination
- Photographs
- Radiographs
- Cephalometric tracing
- Impression taking
- Jaw registration using facebow recordings
- Occlusal registration with wax bite
- Cast analysis
- Mounting casts on an articulator

36 Reflection log

date: attach file:

type:

title:

Description

Who: where:

What happened: What was I thinking and feeling?

Reflection

What was good and/or bad about the experience? What sense can I make of the situation?

Self assessment and Action planning

What else could I have done? What do I plan to do in future?

Discussion with personal mentor/s

Main outcomes

Figure 4.11: One of the forms present in the orthodontic e-portfolio

As shown in Figure 4.12 there was a “PDP review and meeting” form where students summarized the evidence and their written reflections collected in the previous three months. At the “PDP meeting” students discussed the evidence, their written reflections and a future plan of action with mentors. After the meeting academic supervisors compiled the part of the form regarding the assessment of reflection using a password.

38 Meeting records

date: 18/10/2007
attach file:

Main outcomes

PDP review

Main outcomes

Reflection

Action plan:

Opportunities for my learning:

Difficulties to my learning:

PDP Meeting

Reflective ability:

level 1
level 2
level 3

Assessment criteria

Future Action Plan:

16/10/2007	Application basic science ()	Essay (Management of class III malocclusion) Good pass	open
16/10/2007	Application basic science ()	Exam (End of term exam) Good pass	open
16/10/2007	Application basic science ()	Teaching presentation (Tip Edge Technique)	open
16/10/2007	Clinical information gathering ()	Personal folder (Poster) CBCT as diagnostic tool in CLP patients	open
16/10/2007	Communication ()	Case presentation (PE- class III malocclusion ,orthognathic treat)	open
16/10/2007	Communication ()	Exam (End of term exam) Good pass	open
16/10/2007	Communication ()	MSc presentation (Competencies and assessment for the specialist orthodontist(1 year)	open

Figure 4.12: The “PDP review and meeting” form

The database also simplified the process of the assessment of learning outcomes at the end of the year. The form in Figure 4.13 allowed the mentors to record if the students had achieved the learning outcomes at an adequate level during the programme according to the Novice-Expert criteria. Supervisors accessed this page via a password-protected key button.

OUTCOMES
WHAT THE ORTHODONTIST IS ABLE TO DO
 HOW THE ORTHODONTIST APPROACHES PRACTICE
 THE ORTHODONTIST AS A PROFESSIONAL

1. Novice
 2. Beginner
 3. Competent
 4. Proficient
 5. Expert

Main outcomes

	1st year	2nd year	3rd year
Clinical information gathering	C	C	P
Diagnosis and orthodontic treatment planning	H	B	C
Treatment procedures	B	C	P
Orthodontic treatment evaluation	H	B	C
Patient management	B	C	P
Communication	B	C	P
Health promotion	B	C	P
Health and safety	B	C	P
Information handling	B	C	P
Ethical behaviour	B	C	P
Legislation	H	B	C
Decision making clinical reasoning and judgment	B	C	P
Management of research	H	B	C
Application basic science	B	C	P
Professional development	H	B	C
Personal development	C	C	P

Learning outcomes

Interview of patient, relatives and others (child or adult)
 Extra-oral examination
 Intra-oral examination
 Functional examination
 Photographs
 Radiographs
 Cephalometric tracing
 Impression taking
 Jaw registration using facebow recordings
 Occlusal registration with wax bite
 Cast analysis
 Mounting casts on an articulator

DATE	EVENT
16/10/2007	open Personal folder (Poster) CBCT as diagnostic tool in CLP patients

Figure 4.13: The assessment of learning outcomes form

In the first pilot students expressed their doubts about what kind of events and tasks should be recorded to show achievement of learning outcomes. In the database, there was information available to students about which activities they should record for each main outcome (Figure 4.14).

OUTCOMES

WHAT THE ORTHODONTIST IS ABLE TO DO

HOW THE ORTHODONTIST APPROACHES PRACTICE
THE ORTHODONTIST AS A PROFESSIONAL

Main outcomes

Clinical information gathering
Diagnosis and orthodontic treatment planning
Treatment procedures
Orthodontic treatment evaluation
Patient management
Communication
Health promotion
Health and safety
Information handling
Ethical behaviour
Legislation
Decision making clinical reasoning and
Management of research
Application basic science
Professional development
Personal development

Learning outcomes

Interview of patient, relatives and others (child or adult)
Extra-oral examination
Intra-oral examination
Functional examination
Photographs
Radiographs
Cephalometric tracing
Impression taking
Jaw registration using facebow recordings
Occlusal registration with wax bite
Cast analysis
Mounting casts on an articulator

1. Novice	3. Competent
2. Beginner	4. Proficient
	5. Expert

Main outcomes-tasks tables

Main outcomes-tasks table		
WHAT THE ORTHODONTIST IS ABLE TO DO		
Main outcomes	Tasks	Quantity
Clinical information gathering	Assessment records (Clinical observation)	1
Diagnosis and orthodontic treatment planning	Assessment records (exam)	100%
	Record of clinical activity	100-120
	Presentation (Case-presentation)	none
Treatment procedures	Assessment records (Clinical observation)	9
	Record of clinical activity	100-120
	Presentation (Case-presentation)	none
Orthodontic treatment evaluation	Record of clinical activity	100-120
	Presentation (Case-presentation)	none
HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE		
Patient management	Assessment records (Clinical observation)	10
	360 Appraisal	not yet
Communication	Assessment records (Clinical observation)	10
	Assessment records (exam)	100%
	Presentation (MSc presentation)	1
	Presentation (Case-presentation)	none
	Presentation (Teaching presentation)	1
Health promotion	360 Appraisal	not yet
	Assessment records (Clinical observation)	10
Health and safety	360 Appraisal	not yet
	Assessment records (Clinical observation)	10
Information handling	360 Appraisal	not yet
	Assessment records (Clinical observation)	10
	Research records (Journal club)	5

Figure 4.14: The “Main outcomes-tasks table” that shows tasks requested by the institution in order to achieve each main outcome

In the first pilot students did not support the use of a PDA and a “foldable” keyboard to collect evidence in the clinic and to reflect on it. These two tools were used differently in the second pilot to facilitate:

- the collection of events in the clinic for reflection. Students wrote or recorded a short description of the clinical event or attached a file related to the event rather than full portfolio entries. This was useful for refreshing the event in their minds when they were ready to compile the database;
- the assessment of clinical activities. “Clinical observation” was defined as gathering data on and making some judgements about trainees’ abilities by formally watching those performing real clinical tasks. The advantage of real time observation was that it potentially assessed what the trainee was supposed to do in the real world with real patients. The major disadvantage was that clinical observation was a subjective judgment, so a checklist was used to bring some standardisation to the process. During “Clinical observation” clinical mentors compiled the checklist and marked students’ performance using the PDA of their named students;
- communication by means of internet connection. Wireless connection was available in specific areas of the dental school.

Chapter 5 Orthodontic e-portfolio assessment

5.1 *Introduction*

The introduction of personal and professional development learning outcomes, which represented professionalism, in the curriculum of the postgraduate orthodontic programme in Cardiff required an assessment tool for these learning outcomes.

Reflection is a fundamental element of the personal and professional development learning outcomes (Ker 2002; Schön 1983). Reflective portfolios, which represent an appropriate context to assess reflective abilities, have been used to assess professionalism (Ker 2002).

However there were concerns regarding portfolios as assessment tools for reflection and professionalism and regarding the process of reflection assessment, particularly relating to students' and assessors' acceptance (Burnett et al. 2008; Hatton and Smith 1995; Kember et al. 1999; Richardson and Maltby 1995; Sumsion and Fleet 1996; Wong et al. 1995).

The purpose of the third part of this project was to investigate students' and mentors' attitudes to the introduction at Cardiff of a reflective e-portfolio (the revised orthodontic e-portfolio) as a formative and summative assessment tool for reflective abilities, professionalism and learning outcomes.

Objectives of this part of the research were to describe:

- the extent in which students demonstrate a reflective approach using the orthodontic e-portfolio;
- the effectiveness of the orthodontic e-portfolio for identifying the evidence and depth of reflection (summative assessment of reflection);
- the effectiveness of the orthodontic e-portfolio to improve students' reflective abilities (formative assessment of reflection);

- the effectiveness of the e-portfolio process as a tool for summative assessment for personal and professional development learning outcomes and formative assessment of learning outcomes.

5.2 *Method and Materials*

5.2.1 Introduction

There are two approaches in the literature with which to evaluate a portfolio as an assessment tool (Johnston 2004):

- the Positivist approach is based on the belief that student ability is fixed and consistent and can be objectively measured. Baume and Yorke (2002) supported this approach using criteria such as inter-rater reliability and intra-rater reliability in their studies;
- the Interpretivist approach is based on the fact that evaluations are constructed interpretations rather than absolute facts. Webb et al. (2003) supported this approach using criteria such as credibility, transferability and dependability in their studies.

Reflection, which represents the basis of the PDP process in a portfolio, can be expressed in different ways (e.g. reflective writing, discussion with mentors) that permit different levels of interpretation in assessment (Moon 2001). The assessment of reflection can be evaluated both using qualitative (Hennessy and Howes 2004; Schön 1983) and quantitative criteria (Boenink et al. 2004; Burnett et al. 2008; Kember et al. 1999; Wong et al. 1995) or both (Pee et al. 2002; Richardson and Maltby 1995).

On the basis of the recent literature, a “mixed methods” research design (Cresswell 1994), using both qualitative and quantitative strategies, was applied in this study to describe the effectiveness of the orthodontic e-portfolio as a formative and summative assessment tool.

The “mixed methods” allowed the above cited objectives to be addressed by:

- raising the awareness of the students and mentors to the possibility of developing a reflective approach using the orthodontic e-portfolio, to the effectiveness of the orthodontic e-portfolio for identifying evidence and depth of reflection, to the effectiveness of the orthodontic e-portfolio to improve students’ reflective skills and to the effectiveness of the e-portfolio process as a summative assessment tool for personal and professional development learning outcomes and a formative assessment tool for learning outcomes;
- evaluating the changes of students’ reflective abilities and of the reliability coefficient of the marking scheme used in the study for identifying evidence and depth of reflection over a period of time.

5.2.2 The orthodontic e-portfolio experience

The orthodontic e-portfolio, after the changes derived from the first pilot study, was introduced for students as part of the orthodontic programme in Cardiff. The students compiled the orthodontic e-portfolio as part of their first year of training. The participants of the second pilot were a different group of students from the MScD orthodontic programme in Cardiff but the supervisors remained unchanged. The supervisors were called mentors and were still organised into two groups: academic and clinical. The word mentor, as defined by Spicer (2004), reflects the role of teacher, facilitator, counsellor and educational supervisor, which was needed for the second pilot on the e-orthodontic portfolio. The fact that the role of mentor can be combined with that of assessor (Tartwijk and Driessen 2009) represents another positive aspect of the study. The academic mentors were involved in assessment of reflection during the second pilot.

More effort has been made in the second pilot to motivate students and mentors towards the different components of the orthodontic e-portfolio. Students and mentors received more information on the concept of reflection and its assessment by means of meetings and workshops with the researcher before and during the experience. More IT training on Blackboard and the PDA was provided.

An induction period was organized for students and mentors before the beginning of the e-portfolio experience. A seminar about how to use Blackboard had already been scheduled for the students as part of the MScD induction period. Seminars were organized to demonstrate the interface between Blackboard, laptops and PDAs to small groups of students thus allowing almost individual attention.

Students were briefed about the purpose of the orthodontic e-portfolio in the student handbook. The purposes, the structure and the content of the orthodontic portfolio, the portfolio database and the process of assessing reflection were described and discussed in seminars with the researcher organized separately for students and mentors.

Workshops with the researcher about the concept of reflection and its assessment, with some examples and exercises (King 2002; Moon 2001, 2007), were organized separately for students and mentors. The aim of the mentors' workshop was to make the levels of reflection (PDRA, see Table 4.1 for description) explicit to mentors and to have them consider some written reflections and assess them. During the workshops students learned about reflection, stages of reflection and assessment of reflection and received some non-specific examples of written reflection at different levels. Then there were also some exercises where students were asked to write a reflective piece about their experience of student induction at Cardiff University during the previous week. They then had to individuate examples of the three basic levels of reflection (PDRA, see Table 4.1 for description) in their peers' written reflection and discuss the result with peers and the researcher.

During the year, three training workshops were organized separately for students (28-01-08, 07-03-08, 22-07-08) and mentors (24-01-08, 14-03-08, 15-07-08) where they could discuss with others about their personal experience, receive more information about Blackboard, the PDA and the e-portfolio database and achieve a deeper understanding of themes such as reflection and its assessment. Examples of students' reflective writing, taken from students' portfolios, were used to make the different levels of reflection more explicit and find more agreement on them. These workshops were also very useful for the researcher who started to collect impressions and information for developing the interview and focus group questions.

Clinical mentors helped students to use the e-portfolio on a day-to-day basis and the academic mentors met the students three times - January 2008, March 2008, June 2008 - during the year in what was called the “PDP meeting” for the formative and summative assessment of reflection. After each of the three meetings one example of reflective writing was taken from the portfolio of each student. Mentors were asked to mark these examples independently using the reflection marking scheme (PDRA, see Table 4.1 for description) applied in the orthodontic e-portfolio. As this was a trial, the summative assessment of learning outcomes was not performed at the end of the year and the summative assessment of reflection was not taken into account for the final judgement of students in that year.

At the end of the experience the data were collected through semi-structured interviews with mentors and focus groups with students. A qualitative analysis was made which highlighted students’ and mentors’ perceptions on a reflective approach using the orthodontic e-portfolio and on the effectiveness of this e-portfolio to identify evidence and depth of reflection, to improve students’ reflective abilities, to be used as a summative and formative tool for the assessment of learning outcomes. In order to evaluate the changes over time of students’ reflective skills and of the reliability of the reflection marking scheme for identifying evidence and depth of reflection, a quantitative analysis was used to examine the mentors’ marking of students’ samples of reflective writing taken from the orthodontic e-portfolio after each “PDP meeting”.

5.2.3 The study sample

Despite both qualitative and quantitative strategies being used in the study; the sampling technique used was a “Critical case sampling” (Patton 1990). The participants in this study were chosen because of their experience with the orthodontic e-portfolio for one year.

The sample consisted of:

- the 2007/2008 student intake to the MScD programme in orthodontics in Cardiff. There were nine first-year postgraduate students, three males and six females;
- seven supervisors of the orthodontic programme in Cardiff (five males and three females), named mentors.

A random sampling procedure was not applied because the generalisation of the findings to a wider population was not an aim of this research study (Bower and Scambler 2007). Power calculation was not necessary because of the nature of sampling. The sample was comprised of a small number of participants and was not representative of the population.

One of the students left the orthodontic programme during the first year and so he did not attend the focus group at the end of the year.

5.2.4 Research design

A formative “Evaluation research” strategy, already used in the second part of this project, was chosen for this third part.

A descriptive strategy was used to evaluate the changes of the reliability coefficient of the marking scheme used in the orthodontic e-portfolio experience for identifying evidence and depth of reflection over time.

The researcher was a 33 year old female attending the third year of the MSc programme in orthodontics in Cardiff. She had been involved in research in Dental education since 2004 and later followed seminars on qualitative research design, qualitative data collection techniques (interview, focus group and questionnaire) and qualitative data analysis as part of her PhD programme in Cardiff. She used some concepts of qualitative data analysis in the second part of this project “Orthodontic e-portfolio development” where she was also part of the student sample.

5.2.5 Data collection

The data for the qualitative analysis was collected through the semi-structured interviews with mentors and the focus groups with students at the end of the year. The data for the quantitative analysis consisted of the marks mentors had independently given to students' samples of reflective writing using the marking scheme in the orthodontic e-portfolio (PDRA, see Table 4.1 for description).

5.2.5.1 Semi-structured interview

The author considered interviews an appropriate data collection method for studying the e-portfolio as an assessment tool because little was known about it and the mentors were ideally placed to provide a deep insight into the experience.

Semi-structured interviews were chosen because the author had already identified a number of aspects of the orthodontic e-portfolio experience, expressed in the objectives of the study, that were to be addressed (Mathers et al. 1998). However a series of open-ended questions based on these topic areas, encouraged the mentors to express their views, feelings and beliefs in their own words leading to new information the author had not previously considered (Gill et al. 2008; Mathers et al. 1998). An interview topics list was developed in order to achieve the objectives of the study (Appendix XI).

In order to reduce errors and bias and increase validity and reliability (Cohen and Manion 1989; Fraenkel and Wallen 2006; Mathers et al. 1998), several factors were taken into consideration when setting the interviews. The author was the sole interviewer and each mentor was interviewed just once in order to reduce different interpretations that would have made it difficult to find convergence. The author, who knew the three mentors, was able to arrange face to face interviews and set convenient times and locations for them in order to avoid interruptions and to develop an appropriate level of empathy. The interview followed a structure in which questions were asked one at a time, avoiding leading questions. A series of prompts and probes were used to direct the interview, but the interviewer did not give personal opinions and spent more time in active listening. Finally, although the

interviewer was a foreign student she tried to use the correct vocabulary with neutral body language.

5.2.5.2 Focus groups

Focus groups were used for data collection because, in line with Cohen and Manion (1989) and Stewart and Shamdasani (1980), the interactions between students in the focus group could help to build up ideas and concepts about the use of the orthodontic e-portfolio as an assessment tool. Furthermore a focus group is a method of gathering data quickly and at low cost.

The students, who agreed to take part, were divided into two groups of four and the data were collected through two focus groups. All the students had used the orthodontic e-portfolio for one year in Cardiff and knew each other, facilitating discussion and the ability to challenge each other in the group. The time scheduled for each focus group was ninety minutes and was told to the students in advance. The location chosen was informal, comfortable and free from distractions. The author was the facilitator for both focus groups and followed a focus group topics list (Appendix XII). Open-ended questions were asked to encourage students to express their story in their own words. The facilitator tried to encourage all participants to contribute to the discussion and to keep the discussion on track using prompts and probes.

In order to avoid a subordinate relationship that might develop between the facilitator and the students in the focus groups and to create a relaxed environment where students could express their opinions freely:

- students were not hierarchically dependent on the researcher;
- the researcher respected individual, cultural and role differences including ethnicity, gender, language, race, religion and socio-economic status of the students;
- focus groups were two-way processes involving the gathering and giving of information by students;
- a third person was available for discussion if psychological problems arose (anxiety, emotional upset).

5.2.5.3 Reflective writing sample

The academic mentors met the students three times during the year in the “PDP meetings” for formative and summative assessment. After each of the three meetings the author, who had access to all the students’ orthodontic e-portfolios in Blackboard could randomly select one sample of reflective writing by each student. This limitation was a practical consideration. The selected samples were transcribed into a “Microsoft Word” document (Appendix XIII) which was sent as an email attachment to each mentor. The three mentors were asked to mark each of the samples independently using the marking scheme applied in the e-portfolio together with the assessment criteria. The mentors were also asked to send the compiled document for subsequent analysis of the data back to the author.

5.2.6 Ethical considerations

5.2.6.1 Ethical approval

Ethical approval for this part of the research was granted by the Medical Dental School Research Ethics Committee (MDSREC).

5.2.6.2 Informed consent

Participants were free to decide if they wanted to take part in the project. In order to encourage participation, invitations were sent personally by the author (Appendix XIV) and not by a programme organiser but no rewards were offered to those taking part in the study. The author gave all the participants suitable for inclusion in the study an information sheet approved by MDSREC (Appendix XV). It provided potential participants with the same information as the sheet used in the first pilot study but related to the second pilot study. It also asked for the students’ permission to take some written reflections from their portfolios to be used in assessment training exercises for mentors. Before the interviews and the focus groups, the author provided all participants with the same information again and asked them if they had

any doubts or questions about the study. At this point, all the participants who had agreed to take part in the study were asked to sign a consent form that confirmed that they were informed and willing to take part (Appendix XVI).

5.2.7 Data entry and storage

All interviews and focus group discussions were recorded on a sound digital recorder. When appropriate, supplementary written “field notes” of observations made during the discussion and initial thoughts and ideas relating to the data were taken during and immediately after each interview and focus group. The recorded data and the written notes were typed into written transcripts in the “Microsoft Word” documents verbatim to allow a detailed qualitative analysis.

After each mentor had independently marked the samples of reflective writing taken from the students’ e-portfolio, the results were tabulated in a “Microsoft Excel” document.

To conform to the Data Protection Act, the transcripts and the samples taken from students’ e-portfolio were anonymous and could be identified uniquely via a coded notation. Participants’ confidentiality was ensured using unique subject ID codes to identify participants, rather than their names. The code was constituted of two letters, one of which indicated whether they were students (S) or mentors (M) and the other one if they were male (M) or female (F) and a number (from one to eight for students and from one to three for mentors). A list of the ID codes and the participant identifiable data were stored in a separate document. The electronic recordings were deleted as soon as they had been saved on a computer where they were password protected and limited to individuals involved in the data collection process. Furthermore, the data were only analyzed for the purposes of this study and the results were and will be used in ways that will not lead to the accidental disclosure of participants’ identity.

5.2.8 Qualitative analysis

The data collected from the interviews and focus groups was analysed in a qualitative way using a thematic analysis (Green and Thorogood 2004) with a combination of inductive and deductive approaches (Burnard et al. 2008; Spencer et al. 2004). The author, influenced by the theoretical literature available on the use of portfolio as an assessment tool for reflection and the experience gained by running previous training workshops with students and mentors during the year, could foresee probable participant responses. This approach led to a mix of analytic and emergent categories (Strauss 1987).

The supplementary written “field notes” that were taken during or immediately after each interview and focus group gave ideas of some initial categories.

After all the interviews and focus groups, the data were typed together with the “field notes”; each transcript was read and re-read line-by-line by the author. This led to the identification of a number of themes in each transcript that were coded to allow a future categorisation of a series of otherwise discrete statements (McMillan 2009). The theme codes were recorded in the right hand margin of the transcript sheets (side mark coding). The author applied the constant comparative method suggested by Glaser and Strauss (1967) to group themes into categories. The creation of a list of themes (Figure 5.1) facilitated their categorization. The list of themes consisted of different colour coded sections that showed the initial categories (headings in bold in Figure 5.1). Each theme was accompanied by its code that clarified it and linked it to a specific participant and to a location in a focus group or interview transcript. For example in “FG1S2-4 Mentor’s feedback improves reflective skills” FG1 is for Focus Group number one (FG2: Focus Group 2; FG3: Focus Group 3), S2 represents one of the four students that attended FG1 (S1-S8: Students; M1-M3: Mentors), 4 means the location of this theme in FG1 and “Mentor’s feedback improves reflective skills” expresses the concept of the theme.

As Shenton (2004) suggested in order to facilitate the discussion of the results at later stage, the author tried to distinguish themes that recalled some previous experience or literature (analytic) from those emergent from the data collected. In the Figure 5.1

the letter in brackets that follows each theme indicates if it is analytic (A) or emergent (E).

LIST OF THEMES	
Outcomes of reflective process	
FG1S8-1 Earlier (year) solving of problems (A)	
FG1S8-2 Records of reflection (E)	
FG1S7-3 Easier expression of problems (E)	
FG1S2-4 Mentor's feedback improves reflection skills (A)	
FG1S2-5 Discussion helps in the reflection process in action (E)	
FG1S4-6 To improve own reflection skills (A)	
FG1S4-7 To show own level of reflection (E)	
FG1S1-8 To see own weaknesses (A)	
FG1S1-9 To give encouragement (A)	
FG1S1-10 To give motivation (A)	
Feelings about showing reflection and deep reflection for assessment	
FG1S7-1 Difficult to share emotion (new job, new mentor) (A)	
FG1S7-2 Training helps (E)	
FG1S2-3 Weird and slightly intimidating (new job, new mentor) (A)	
FG1S2-4 Training helps (E)	
FG1S2-5 Approachable mentors (E)	
FG1S4-6 Difficult to share emotion (new job, new mentor) (A)	
FG1S4-7 Training helps (E)	
FG1S4-8 Relaxed mentors (E)	
FG1S1-9 Emotions are personal, difficult to write at the beginning (A)	
FG1S1-10 Discussion with mentors helps to express emotions (E)	
FG1S8-11 Quite easy because mentors are approachable, not intimidating (E)	
FG1S8-12 Sharing emotion makes you feeling good (E)	
Improvement of reflective abilities	
FG1S2-9 Due to feedback from mentor (A)	
FG1S1-10 Due to discussion with colleagues and examples of their reflection (E)	
FG1S4-11 Due to feedback from mentor (A)	
FG1S8-12 Due to getting a mark (E)	
FG1S8-13 Due to discussion with colleagues (E)	
Achievement of learning outcomes of the course	
FG1S1-1 Discussion with mentor guides in achievement of learning outcomes (A)	
FG1S8-2 Discussion with mentor helps in achievement of learning outcomes (A)	
FG1S8-3 Discussion with colleagues helps in achievement of learning outcomes (E)	
FG1S8-4 Learning outcomes are too broad and too vague (E)	
FG1S8-5 Portfolio helps to remember the learning outcomes of the course (A)	
FG1S7-6 Portfolio directs in achievement of learning outcomes (A)	

Figure 5.1: A section of the list of themes created from the FG1 transcript
Four initial categories are represented (in bold) with the associated themes.

The process of theme identification and the creation of a theme list were carried out for each focus group and interview transcript. The theme list also helped in the comparison of different transcripts in order to use the same code where the same concept was expressed and to create new theme codes where an emerging concept was not described by pre-existing ones.

When the themes were identified in each transcript and they were grouped in the themes lists in the initial categories, information on reflection and assessment of reflection taken from the literature helped to define rules of inclusion for each initial category and to re-organize the themes into categories (McMillan 2009) where needed.

At this point a data dictionary (Shenton 2004) was created that cited a list of the categories and the associated codes, which were abbreviated representations of the concepts. The categories were grouped into a series of sections (colour coded) of the data dictionary, each of which was linked to one of the objectives of the study (Figure 5.2).

DATA DICTIONARY
Definition of reflection (ref/ def)
Stimulation of reflection (ref/ stim)
The experience of reflection (ref/ exp)
Assessment procedure (ass/ proc)
Assessment criteria for reflection (ass/ ref/ cri)
Summative assessment and reflection (ass/ ref/ sum)
Discussion with peers on the experience (disc/ peer/ exp)
Evidence of reflection improvement (ref/ impr/ evid)
Reasons of reflection improvement (ass/ ref/ form)
Double role of mentor and assessor (doub/ rol/ men/ assor)
Formative assessment of learning outcomes (ass/ lear-out/ form)
Summative assessment of learning outcomes (ass/ lear-out/ sum)

Figure 5.2: The data dictionary

The data dictionary facilitated the comparison between different categories and permitted a better definition of the codes. At this stage of the analysis it was possible

to group some categories if they represented similar concepts and to investigate the relationships between different concepts in the later stage of the analysis.

After coding the categories the author went through each focus group and interview transcript again and put the category codes in upper case letters into the text. This made the degree to which the categories covered all aspects of the interview and focus groups transcripts visible (Shenton 2004). Therefore using the “Find” facility of “Microsoft Word” it was easy to locate text sections associated with a certain code category thus facilitating the construction of a database of data (Shenton 2004). A database record was created using “Microsoft Access” and each record included the following fields: participants’ code and gender, a theme, a category and its code, the transcript identifier (from which focus group or interview the citation originated), the transcript citation and its identifier that expressed the citation’s location in the transcript (Figure 5.3).

The screenshot displays a database record form with the following fields and values:

- Number:** 13
- CATEGORY:** STIMULATION OF REFLECTION (Re/Stim)
- theme:** Discussion with mentor (feedback)
- MENTOR/STUDENT:** S4
- INTERVIEW/FOCUS GROUP:** FG1
- PAGE:** 13
- SEX:** M
- sentence 1:** Yes, if you asked me what was the best thing, it is meeting with mentor. So, because you know where you stand when you begin the reflection and how to improve your skills through a mentor and also to reflect on the same coursework.
- sentence 2:** and how our learning is going and to know where we are going to the right direction.
- sentence 3:** (empty field)

Navigation controls at the bottom include arrows for previous/next record, a search icon, and a status bar showing 'Record: 14 / 4' and '3 / 335'.

Figure 5.3: A database record page

Stimulation of reflection (category), Ref/ Stim (category code), Discussion with mentor (theme), S4 (participant’s code), FG1 (transcript identifier), 13 (transcript citation identifier), M (gender) and Sentence 1, 2 and 3 (transcript citation).

The database allowed the author to group all the transcript citations related to a category and to print them onto a sheet of paper with each section of text labelled by an identifier. Reading those sheets helped the author to refine the rules of inclusion for each category, to identify negative cases and to investigate relationships between

different concepts on the basis of the data emergent from the transcripts. Furthermore, the database search facility via the range of fields led to the identification of patterns (category, mentor/student, sex and interview/focus group) and investigation of their prevalence (see the top of Figure 5.3).

The relationship between categories identified through the data dictionary and the database were expressed by the creation of concept webs (Miles and Huberman 1994; Shenton 2004). The relationships were highlighted using a concepts diagram (flowchart) where it was also possible to see the negative cases (Figure 5.4). The analysis of the relationships between the categories led again to some changes in the categories. These amendments were also made in the transcripts, the data dictionary and the database where required.

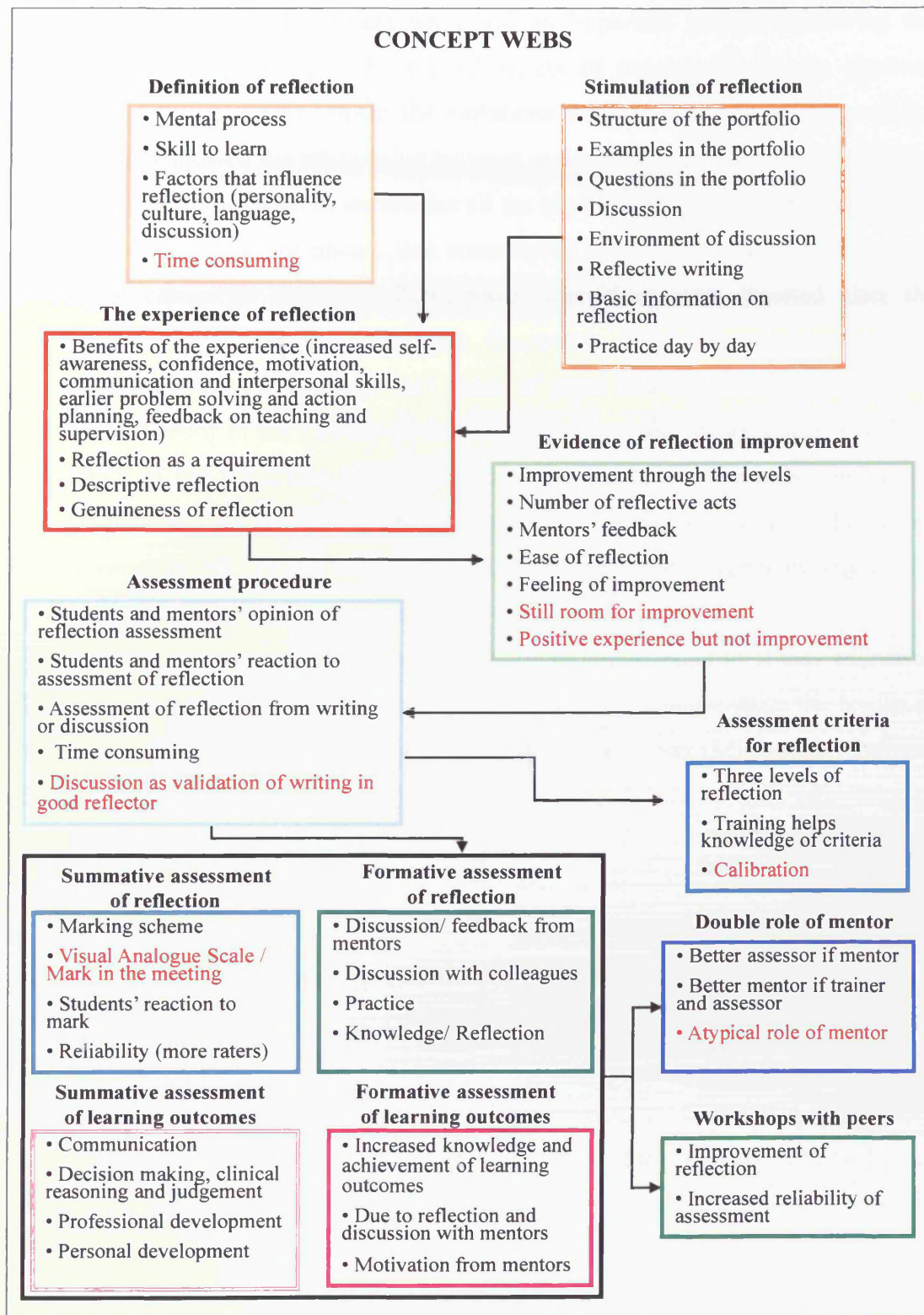


Figure 5.4: Concept Webs

Each category is represented by a coloured box and different shades of the same colour represent the relationship among categories shown in the data dictionary (Figure 5.8). The entries in red are the negative cases within each category.

The database record and concept webs had an important role in structuring the writing up of the findings. The printed sheets of paper with all the citations associated with a category made the variations within a concept visible and the concept webs showed the relationship between different concepts. In the descriptions of findings the author tried to summarize all the similar data and to relate these to the study objectives. The statements that summarised similar data were organized to define the categories precisely. Participants' identifiers were inserted after the statements to strengthen the audit trail. Quotations with their own participant's identifiers were taken from the printed sheets of paper and used in the description of findings as a proof of the validity of the study. The database record also allowed the description of the results on the basis of determinate patterns such as opinions of students/mentors and males/females. As typical in qualitative analysis, the author also showed, as part of the results, the data that were not covered by any of the statements, usually called negative cases.

The last phase was to summarize the study findings and to examine if they addressed all the objectives of the research. The author used charts to summarize the results of the study and to show them in an easy and understandable way (Miles and Huberman 1994).

As suggested by Shenton (2004) the author used some common software, such as "Microsoft Word" and "Microsoft Access" together with paper methods to make the analysis of qualitative data quicker and easier. After careful consideration Computer Assisted Qualitative Data Analysis Software (CAQDAS) was not used. Such programmes are not well suited to the analysis of the research's data and they do not confirm or deny the scientific value or quality of quantitative research; they simply manage the data and permit the researcher to retrieve them quickly (Burnard et al. 2008). They are more useful if there is a large amount of data (Green and Thorogood 2004), which was not the case in this study.

5.2.9 Quantitative analysis

After each mentor had independently allocated the students' writing samples to one of the three levels of reflection, the marks were coded and tabulated in a summary

data “Microsoft Excel” document. The author compared the levels of reflection allocated by the different mentors and calculated inter-judge agreement (IJA) as follows:

$$\text{IJA} = (\text{number of agreement} / (\text{number of agreement} + \text{number of disagreement})).$$

This approach to studying the reliability of a marking scheme has already been used by Wong et al. (1995). The value of IJA goes from 0 to 1, the closer the value is to 0 the more it represents disagreement and the closer the value is to 1 the more it shows agreement.

5.3 Results

5.3.1 Introduction

The data collected by the focus groups with the students and the interviews with the mentors are presented in this section. The categories and themes that emerged from the analysis process were used to provide some structure and clarity in the data. The database record, where all the citations are associated with a category and theme, and the concept webs, which show the relationship between different categories, helped the author to write up the findings. The author used statements, which summarized all the similar data, and citations to describe the results. Statements and citations were followed by the participants’ identifiers in order to strengthen the validity of the study. The identifier links a statement or a quotation to a specific participant and to a location in a focus group or interview transcript (see section 5.2.8). The database record and the concept webs also enabled the description of the results on the basis of determinate patterns (e.g. mentors/students) and of disparate participant experiences (e.g. negative cases).

Finally, the author summarized the study findings using four charts, each of which is related to one of the study objectives.

The different steps in the data analysis and summary brought a certain level of interpretation, although the author tried to present the data as told by the participants themselves.

The categories generated by analysing the data and their codes are listed below:

- definition of reflection (ref/ def);
- stimulation of reflection (ref/ stim);
- the experience of reflection (ref/ exp);
- evidence of reflection improvement (ref/ impr/ evid);
- assessment procedure (ass/ proc);
- assessment criteria for reflection (ass/ ref/cr);
- summative assessment of reflection (ass/ ref/ sum);
- formative assessment reflection (ass/ ref/ form);
- workshops with peers (work/ peers);
- double role of mentor (doub/ rol/ men);
- formative assessment of learning outcomes (ass/ lear-out/ form);
- summative assessment of learning outcomes (ass/ lear-out/ sum).

5.3.2 The definition of reflection (ref/def)

Both the focus groups and interviews began by addressing the question of the definition of reflection. The group of students was heterogeneous; there were three different nationalities with different cultures and religions. Some of them had previous experience using reflection but the majority did not. However all students received an introduction to the concept of reflection and its assessment. The mentors were more familiar than students with the concept of reflection, but not with the assessment of reflection. They also received an introduction to reflection and assessment.

The majority of students described reflection as a mental process that through a series of steps takes the individual to the solution of a problem (FG1S4-15, 16) (FG1S8-12, 13, 14) (FG2S6-2) (FG1S2-11) (FG2S3-4).

Some students defined reflection as the deep analysis of the situation and its context in order to get the solution to a problem (FG1S4-15, 16) (FG2S6-2):

“You count the weaknesses and the causes of the problem and try to understand from where the problem comes: from me, from another person or from the context. Then you go to organising your thinking on a way to a solution.” (FG1S4-15).

Some others added that in order to find a solution it is important to also highlight the positive aspects of an experience and discuss it with somebody else (FG1S8-12) (FG2S3-4):

“you think back to what you have done, your good points and your bad points and I think sometimes discussing with somebody can give you ideas of how to solve the problem.” (FG1S8-12).

One of the students confirmed the importance of discussion and added that the other person in the discussion should be somebody close to make reflection easier:

“...as talking with my mum....you often find that when you discuss with somebody close to you, you feel better and more comfortable.” (FG1S2-11).

One of the students deeply described reflection as a process that helps people to become self-learners. People reflect on their own experiences pointing out the positive and negative aspects of the situation in order to spot if changes are needed for improvement. These changes represent new learning that will affect future actions:

“Reflection is a thought process you go through and think how I have done this, have I done it wrong? If it is done wrong how can I better myself and if I did it okay is there any room for improvement. You add the improvement to a filing system in your brain; you know this is how I can go about doing it next time.” (FG2S6-2).

On the other hand, during the interviews the mentors discussed more about the characteristics of reflection rather than giving a definition. During the “PDP meeting” with the students they noticed that some students were good reflectors and others were less, so they tried to explain the factors that influence heterogeneity such as culture, experience and language (IM1-1,2,4,15,16,22) (IM2-1) (IM3-1,2).

Reflection was considered as a skill to be learnt depending partly on personality:

“I think it is a skill, it takes to learn.and it depends to a certain extent on their personalities, they are not used to be open.” (IM1-15, 22).

Mentors described culture and language as factors that influence reflection:

“....partly from the culture they come from, they have not got that reflective approach to analysing the performance. They are used to doing what they are told and then learning by just doing what they are told rather than critically analysing the performance.” (IM2-1);

“ I think that some of the other students whose first language is not English have probably struggled a little bit, not just with the reflection but also

actually translating thought into something which is written down.” (IM3-2).

One of the mentors added that experience and training are needed to make people good reflectors:

“I think they are developing a reflective approach. I do not think it is coming naturally; I think they have to work quite hard to develop this approach. One of them certainly has had experience of reflective writing during her undergraduate course and she seems to be one of the better reflectors.” (IM3-1).

Another mentor said that reflection is a time consuming process (IM1-20).

5.3.3 The stimulation of reflection (ref/stim)

The second question for focus groups and interviews was regarding the factors that had stimulated reflection during the year in which students and mentors had been using the orthodontic e-portfolio.

Both students and mentors commented that the reflective part of the portfolio, that was structured so that each reflection act was attached to a learning outcome of the programme, facilitated reflection (FG1S1-1, 2 14) (FG1S2-5) (FG2S3-5) (FG1S4-6) (FG2S5-12) (FG1S7-4) (FG1S8-3, 4) (IM1-8).

The portfolio’s structure helped students to be organized in their reflections:

“It makes me more organized because it is divided in many topicsso it has given me an idea on what to write....” (FG1S1-1);

“It is well structured and quite helpful as everyone has said before. Just helping you to organize your thoughts and then that helps bring out from you what you are trying to say....” (FG1S2-5).

The questions (what, how, why) and the examples of reflection in the portfolio were also considered helpful in guiding students in the process of reflection (FG2S5-12) (FG1S1- 2, 14) (FG1S8-3):

“I think that having the questions to prompt you to answer helps me and guides me in reflectionit gives me input to write on the right points.” (FG1S8-3);

“....and with keys points like what, when, where and how ...it has given me an idea.....on how to write and how to reflect.” (FG1S1-2).

However, the structure of the portfolio that facilitated the reflection process required a certain time to be understood before the benefits could be felt (FG1S4-10, 11) (FG2S6-2):

"I did not do it before, it was new at the beginning so I did not know exactly what was going on but later when I got used it became easier to use..." (FG1S4-11).

The meeting with the mentor was an important moment to stimulate reflection. Students described the discussion as the best way to help the process of reflection in action (FG1S2-5) (FG2S3-6, 10) (FG1S4-13) (FG2S5-7, 11) (FG2S6-8, 9, 17) (FG1S8-2):

"I think the meeting is better because sometimes talking with someone helps you say what you are thinking whereas writing does not always get it out." (FG1S2-5);

"During discussion there are more examples and it will actually show you how to do it (reflect)." (FG2S5-11).

Furthermore students received useful feedback from the mentors on their reflective skills during the "PDP meeting" so that they could become good reflectors (FG2S6-17) (FG1S8-2, 15) (FG1S4-13):

"The best thing, it is the meeting with the mentor because through the mentor you know where you are when you begin to reflect and how to improve your reflective skills" (FG1S4-13).

Students explained that the factors that made discussion the best way to stimulate reflection were the relaxing, comfortable, pleasant and non-intimidating environment of the "PDP meeting" and easy-going mentors (FG1S4-17) (FG1S7-18) (FG2S6-13,14) (FG2S5-15) (FG2S3-13).

The mentors confirmed that the meeting environment was informal, not intimidating and without stress (IM1-13) (IM2-10). They also agreed that discussion in the meeting was a good tool to help students in the reflection process (IM1-10, 11), to offer feedback to students of their reflective abilities (IM3-8) and to motivate them to go on reflecting (IM2-8, 9):

"....in discussions there are a lot of more things on which people reflected that they did not actually put down in the portfolio. Writing is quite time consuming." (IM1-10);

“ Their written reflection were getting better as we went along and the written bits I think were getting better because of verbal interaction.....personal interaction to help them to understand what they should be writing about.” (IM3-8);

“Talking about reflection probably made them feel a bit more comfortable about carrying on and doing it.” (IM2-8).

However, some other factors were considered important in developing a good reflector such as reflective writing that permitted students to practice reflection day by day (IM1-18,19,23,24,25), and basic information on reflection obtained before and during the e-portfolio experience (IM2-7) (IM1-12,23):

“ I think more training on reflection maybe and more easiness of documentation about reflection because they do a lots of things and think about a lots of things but they do not actually write them down most of the time and if you are not writing them down you have forgotten them a week later, unless it is a major incident and most of the learning processes are incremental and small.” (IM1-23).

On the other hand, only one student affirmed that reflective writing was a useful element in stimulating reflection. It could be used as record of reflection:

“It is useful for me to know where you began and where you are going in the reflection process looking at the previous writings.” (FG1S4-7).

5.3.4 The experience of reflection (ref/exp)

The experience of using the reflective orthodontic portfolio for one year and meeting and discussing three times during the year brought some benefits both to students and mentors.

Students explained that the act of reflecting increased their self-awareness, confidence and motivation in the orthodontic programme (FG1S1-8, 9, 10) (FG2S5-6, 8) (FG2S6-6) and in the reflection process as well (FG1S4-6, 7):

“...reflection helps me to focus on my weaknesses and to improve myself, and on the other hand it gives me some encouragement when I write down or discuss about my success in other situations.” (FG1S1-8);

“Reflection shows how are my reflective skills now at the beginning and how they can improve with time through the writing and the discussion which are in the portfolio.” (FG1S4-6).

Some students noticed that during the experience with the portfolio there was an improvement in their communication and interpersonal skills due to the interaction with mentors and peers (FG1S7-3) (FG2S3-7) (FG2S5-9).

Some others commented how during the reflective experience they could solve their problems earlier in the programme and organize an action plan for the future (FG1S8-1) (FG2S6-5):

“I think the reflection process helps to highlight some issues or problem avoiding sweeping them under the carpet and forgetting about them. It helps to bring up the issue earlier on and to not postpone it until you regret.” (FG1S8-1).

Mentors confirmed an increase of students’ self-awareness, confidence and motivation in the orthodontic programme during the reflection experience (IM1-3) (IM2-2, 3, 4, 5) (IM3-4) (IM3-3):

“Reflection can improve their awareness making them to appreciate that you do not get an understanding of everything on day one of the course.....” (IM1-3);

“ She was absolutely delight by the positive feedback from the mentor.....she was unsure in her performance in general andreflecting on that has given her more self-confidence to be able to feel that she could tackle that procedure on any patient at any time with the same level of outcome.” (IM2-3, 4, 5).

Mentors added that the process of reflection also benefited them (IM2-11) (IM3-4):

“I thought I had taught that topic quite well in the beginning....her process of reflection benefited her and menow I know how to improve my teaching next time.” (IM2-11).

Along the same line two of the students pointed out that the discussion with the mentor was also a good moment to talk about the programme organisation (teaching and supervision problems) and was helpful in getting some improvements in that field (FG1S4-10) (FG2S3-1).

Although the benefits of the experience were recognised, mentors affirmed that at the beginning of using the portfolio there was a lack of understanding of reflection by the students and reflection was only seen as a programme requirement (IM1-21,3,8,14) (IM2-3,4,5):

“I think some of them have not really grasped the idea of what reflection is in its fullest content.....it is a predominance of need and demand that natural reflection which most postgraduate students have in the initial phases.” (IM1-8, 14).

Mentors went on to say that later in the experience students reflected more genuinely but they mainly did it in a descriptive way and just for the meeting instead of day by day (IM1-6, 7, 12) (IM2-12) (IM3-5, 9, 10, 12) (IM2-13):

“....implies that they made, not made it up, it has happened but it is done for the meeting as opposed to part of a daily routine.” (IM1-7);

“They started off by giving us some facts but not a great deal of reflection on those facts....” (IM3-5).

The mentors added that the genuineness of reflection might be influenced by other factors: whether females were more honest than males (IM2-12) and the lack of spontaneity in written reflection (IM3-13):

“Regarding genuineness I think females make better reflections than men in my experience, so I was very comfortable with the genuine nature of the girls.” (IM2-12);

“You write down what you are prepared to let people see which may not necessarily be what your reflection was at the time.” (IM3-13).

5.3.5 Evidence of reflection improvement (ref/impr/evid)

Students pointed out that the experience gained with reflection during one year improved their reflective skills and it was evident in the quality of reflection, the ease of the reflection process and the number of reflection acts at the end of the year in comparison with the beginning of the experience.

Students affirmed that they could see an improvement in the level of their reflection through the comparison of their written reflections at different times during the experience (FG1S4-1) (FG1S7-7) (FG1S1-8) (FG2S5-1) and it was confirmed by the feedback they received from the mentors during the “PDP meetings” (FG1S4-1) (FG1S1-2, 8) (FG2S3-7) (FG1S7-7):

“Oh yes, definitely. ...the previous reflections were very brief and now.....you reflect more, on what you have done wrong, on what you have done good, on what you need to do to improve and if you have already improved how to use this improvement in other situations.” (FG2S5-1);

"I think I have noticed a lot of improvement when I looked at my first reflection writings. I noticed a difference in the way of reflecting and also my mentor has said the same." (FG1S7-7).

Some students explained that there was an improvement because they felt the process of reflection becoming easier during the year (FG1S1-3) (FG2S5-1, 5) (FG2S6-9) and they found themselves reflecting on more things (FG1S1-4) (FG2S5-5):

"...because I start to write more in more topics and I found it easier to write now than before and to reflect on the first points." (FG1S1-3, 4).

One of the students said he had a feeling of improvement:

"It was not a conscious thing of what I did on the last time and what I need to do, it was more like a feeling when I was writing in the portfolio on the day....so I thought there must have been an improvement." (FG2S3-8).

Two of the mentors noticed an improvement of students' reflective skills during the experience. They talked about an improvement in the quality of reflection through the levels (IM2-4, 6) (IM3-2) (IM3, 7) and in the number of reflective acts (IM2-3) (IM2-6) (IM3, 7):

"The accounts they wrote were a little fuller, there was more information there, and there was more reflection there. So it was not just- I did this, I did that- they were putting it into the context of their interaction with the patients." (IM3-2);

"I think they started off not knowing what to write. You know, they would normally put things that they thought they have done badly, because they thought that was what coming to see the mentor was about; being told off for not doing things as well as they should....they improved on their ability to be reflective over the period of time, both in the breath of what they have said about and the number of things they have reflected upon. So they have done it more often and deeper." (IM2-4, 6).

However the same two mentors clarified that there was still room for improvement through the levels of reflection (IM3-11) (IM2-6):

"They are getting better at the reflective bit, but I do not think they have quite got the hang of the evidence to support any statement that they make in terms of what they think they can do." (IM3-11).

The third mentor did not see an improvement but thought the experience was positive:

"I think that it is a good thing and that reflection should improve with time." (IM1-2).

5.3.6 The assessment procedure (ass/proc)

Students expressed a positive view of the assessment of reflection because both the feedback (FG1S2-1, 2) and the mark (FG1S8-12) (FG1S6-8) (FG1S5-9) from the mentors could help them to improve their reflective skills:

“ The assessment procedure was good and helpful in improving my reflective skills, it is good to get feedback so you can find out how you are getting along reflecting, the same it would be with anything else,and you know what you are supposed to be doing next.” (FG1S2-2);

“...and then if there is a mark, yes I would try a little bit harder in order to do better.” (FG1S5-9).

To the question “How did you feel about showing your reflection and deep reflection for assessment?” the students replied that it was difficult particularly at the beginning and particularly regarding the expression of emotions and feelings (FG1S1-9) (FG1S2-3) (FG2S3-1) (FG1S4-6) (FG2S6-4) (FG1S7-1).

With time (FG2S6-2) (FG1S2-4) (FG1S4-7), more understanding of the process (FG1S7-1) (FG1S1-9) and help from the mentors (FG1S2-5) (FG1S4-8), they found sharing reflection for assessment easier especially during the discussion with the mentors (FG2S3-3) (FG2S6-4) (FG1S5-6) (FG1S1-10):

“At the beginning it was hard to reflect.....you come to a new job and a new mentor and everything is new and you just try to reflect and show your emotions and feelings about different things in the course.....but with time and the very approachable mentor it becomes easier.” (FG1S4-6, 7, 8);

“It is a very personal thing, I did not like writing my reflections and deep reflections about different situations but after having my first meeting with the mentor I understood that it is very useful to reflect on all the points and you feel better. So I get used to it know.” (FG1S1-9, 10).

Only one student found sharing reflection and deep reflection quite easy from the beginning both in discussion and writing (FG1S8-11, 12).

Mentors were not really confident at the beginning in assessing reflection because it was a new task and required the consideration of many aspects, but they coped with it (IM1-1) (IM2-11) (IM3-15):

“It took me a while to begin to work through distinguishing between whether writing a lot meant they were better or whether the words they used were more succinct and therefore a better reflection.” (IM2-11).

One of the mentors affirmed that although it was a pleasant experience (IM1-11), the assessment process was quite difficult because they were actually trying to judge more than one thing:

“It is quite difficult because you actually judging two things: One, the status of their ability, the stage of their knowledge and also their ability to reflect on what they have done.” (IM1-1).

All the mentors described the discussion during the “PDP meeting” as the best moment to assess reflection and deep reflection especially at the beginning of the students’ experience (IM1-15) (IM2-5, 7, 12, 14, 18) (IM3-5, 11):

“Making a judgement of the reflective writings is different than making a judgement when you have had the statements from the student and you have also the student there. There is that interaction which may make things different.” (IM3-11).

Mentors added that in the experience in Cardiff there were some factors that contributed to making discussion the best moment to assess reflection such as: personality (IM1-10), culture (IM1-16) (IM2-16) and language (IM1-15) (IM2-6). These factors can influence the assessment of reflection results.

However two mentors used reflective writing as a starting point to judge students’ reflective skills (IM2-18) (IM3-5) and as a record of the meeting for future comparison (IM3-14). One of the mentors affirmed that discussion was a validation of students’ reflective writing ability only in the case the student was a good reflector (IM1-12, 13).

Both students and mentors pointed out that the assessment of reflection should not be considered as time consuming, although for different reasons. Students thought that it did not interfere with other activities (FG2S6-8) (FG2S5-11), mentors thought it was important and was a complementary assessment to those already present in the orthodontic programme in Cardiff (IM1-9) (IM2-8) (IM3-8).

5.3.7 The assessment criteria for reflection (ass/ ref /cri)

Every assessment requires some criteria that should be clear to students and assessors. When students were asked if they knew what they were judged on during the assessment of reflection they answered differently.

Most of the students affirmed that they received a mark based on their ability to analyse an experience, to think independently, to start the process of problem solving and to plan future improvements (FG1S8-10) (FG2S6-5,6,14,15) (FG2S5-17) (FG1S2-4):

“ You need to go back to the experience, it is a logical thought process and you go through each stage and reflect on them and see whether, which step was that produced difficulty... .. you think about what you have done, how you have done it and why, and think about how you can improve yourself.” (FG2S6-14, 15).

Only one of them added that they were judged on their capacity to link their experience to one of the learning outcomes of the programme (FG1S1-6).

Mentors explained that it was good to have criteria to be used as a framework in the assessment of reflection. They used the definitions of the three levels of reflection as criteria to judge reflection (IM3-1, 2, 4) (IM2-4) (IM1-3):

“ They allow you making a judgement about how well they are able to reflect and they also allow you saying how well they are using the evidencethe “because word”this is one of the strengths of these criteria. I also think it is helpful for the students to understand those criteria as well.” (IM3-4).

However the mentors added that in order to use these criteria to judge reflection they should spend time to become very familiar with them (IM3-3, 10). Furthermore if these criteria were to be used in summative assessment it would be quite useful to calibrate them to decrease the subjectivity of the assessment (IM1-5, 6, 7, 8) (IM3-10):

“probably want to have a proper calibration type exercise and have a number of statements and ask all of us to grade those statements and see how close we got and then look at the outcome and we sit around and discuss it and say why we thought that was a two rather than a three and

come to a little bit closer and then do it again and see if we were getting a bit better and that would be the way to do it.” (IM3-10).

5.3.8 The summative assessment of reflection (ass/ref/sum)

The assessment of reflection in the experience was formative and it did not count in the students’ final results, even if with the intent to be summative in the future. The assessment process was considered straightforward by the students (FG2S6-2, 3, 4), the marking scheme was clear and the three levels of reflection proved to be appropriate in number (FG1S1-7) (FG2S6-7) (FG2-S5-9) (FG2S3-12):

“I think the assessment process was fairly straightforward. It was clear how the marks were set and the results were expected.” (FG2S6-2, 3, 4).

The students pointed out a way of improving the assessment process of reflection (FG1S4-5) (FG1S8-11) (FG1S1-8) (FG1S7-13):

“I think it could be improved if you got the result in the meeting...a one or a two and you know why you got a one or a two and how it could be bettered. If you have a discussion about that result that would be beneficial for the assessment process.” (FG1S4-5).

Only one of the mentors sustained that three levels of reflection were too few and there was always a tendency to put people in the middle band and that a Linear Analogue Scale would be a better way to mark reflection (IM2-1, 2, 3).

Some of the students considered that there was a risk in using summative assessment to get more descriptive reflection and less emotions and feelings from students (FG2S3-10) (FG1S4-13, 14) (FG1S7-15):

“....it will be a more stressful procedure and you will be careful about what you want to reflect on.” (FG1S4-13).

On the other hand mentors explained that allocating marks might affect student’s reflection but they were mature and should be able to understand the value (IM1-5) (IM2-7) (IM3-5):

“..... if they reflect on it well then they get a high score. So it is not to do with whether they are good students or bad students or whatever, it is whether they can reflect or cannot.” (IM2-8) (IM3-7).

To increase the reliability of the mark in the assessment of reflection, mentors proposed to use more than one rater (IM2-9) (IM3-9) but obviously that would be time consuming and the students would probably get quite fatigued repeating the same things more than once (IM3-12,13) (IM2-9):

"...really improve reliability because you have got more than one opinion on a particular student...the difficulty here is the time involved in somebody seeing all of them." (IM3-9).

5.3.9 The formative assessment of reflection (ass/ref/form)

In the section 5.3.5 "Evidence of reflection improvement" both mentors and students acknowledged that there was an improvement in students' reflective abilities. In this section the reasons for that improvement are discussed.

The discussion with the mentor during the meetings and the feedback obtained were considered as reasons for improvement in reflective abilities (FG1S2-3, 9, 4) (FG1S4-11) (FG1S8-13) (FG2S5-2, 10) (FG2S3-6) (IM1-4) (IM2-5):

"I certainly did improve and I think it was the one to one discussion with the mentor that caused most of this improvement....I mean the good feedback on reflection from the mentor." (FG2S3-6);

"I thought the meeting with the mentor was probably the best thing...it is also nice to see you are making progress and picking up on things that you should be reflecting on and this helps you to move on." (FG1S2-4);

"...And then I think I started talking to them saying- It is good to critically reflect on under-performance but it is also important to reflect of good performance and what you did well because it will motivate you and there is always ways you can improve again-." (IM2-5).

Both students and mentors expressed the idea that the improvement in reflective skills went with the same speed of the increased knowledge in the reflection process (FG2S6-9) (IM1-4) (IM2-1) (IM3-1) and in orthodontic topics and tasks (FG1S7-6) (FG1S1-12) (IM2-2):

"I think there was an improvement. I think the improvement was partly because they began to understand more why they were doing it, but also partly it was due to the fact they are now coming –up to one third of the way through a three years programme and they began to understand more about orthodontics." (IM2-1, 2);

"...because now we get more with the clinics and with all the orthodontic topics so I know what to write and about what to write." (FG1S1-12).

Time and practice with reflection were also thought as other reasons of improvement by both mentors (IM1-7, 17) (IM3-3) and students (FG1S8-5) (FG2S5-4) (FG1S1-3):

“So I think it is working and I think it is a slow process and the experience that we had I would say suggests that they are getting better at it as time has gone on.” (IM3-3);

“I find there is an improvement on my reflective abilities. I think merely because there is more practice with reflection.” (FG1S8-5).

5.3.10 Workshops with peers (work/peers)

During the experience with the e-portfolio students also attended workshops with their colleagues and the researcher, where they discussed their experience with reflection up to that point. They also had the chance to see anonymous written reflections at different levels taken from their portfolios. The workshops (FG1S2-9) (FG1S1-10) (FG1S4-11) (FG1S8-13) (FG2S5-2, 10) (FG1S8-2, 16) (FG2S6-9) and the examples of other students’ reflective writing (FG1S1-10) (FG2S5-3) proved to be good ways for students to improve their reflective abilities:

“... then having the workshop with the other students again reinforces and guides us on what we are doing with our reflection.” (FG1S8-16).

During the one year experience with the orthodontic e-portfolio the mentors met three times together with the researcher to discuss reflection and its assessment. During those workshops they also had the opportunity to discuss and compare the marks they gave to the same samples of reflective writing taken from the students’ portfolios after each “PDP meeting”.

Mentors affirmed that those workshops made them feel less isolated in the experience and they could compare what they were doing (IM1-17) (IM2-19) (IM3-16) thus improving the assessment of reflection:

“I think those meeting, even if you do not have the situation where you have seen more people in reflection, if the mentors get together afterwards and share the experience that raises the consistency and reliability because you begin to pick up how you varied from your colleagues in some of the ratings you gave on the same reflective experience.” (IM2-19).

5.3.11 The double role of the mentor (doub/rol/men)

During the one year experience with the e-portfolio students had three one-to-one “PDP meetings” with a mentor who was at the same time the person judging their reflective abilities in a continuous way.

Some students did not have any problem to discuss with a mentor that was also an assessor (FG1S8-14) (FG1S6-11) (FG2S3-12), some others found it better because (FG2S5-13) (FG1S7-16) (FG1S4-17):

“I think it is easier to talk with somebody you know than somebody you do not know.” (FG1S7-16).

All the mentors sustained the view that it was possible to have a double role of assessor and mentor and they actually believed that they were better mentors because they were also trainers and assessors (IM1-6) (IM2-6) (IM3-4):

“It is better if the mentor is also a trainer and an assessor because if you are just a mentor you have only the observation of students’ reflection about that one thing that gave them causes to reflect, whereas if you are a trainer and assessor you can triangulate a bit.” (IM2-6).

One of the mentors also said that the role of the mentor in the portfolio experience was not the usual one; he explained that students could not bring all their problems to the meeting with the mentor (IM3-6).

5.3.12 The formative assessment of learning outcomes (ass/lear-out/form)

The reflective e-portfolio with its related activities (discussion with mentors and peers) could also be intended to be used as a formative assessment tool for the learning outcomes of the orthodontic programme.

One student said that the experience with the e-portfolio helped him to keep clear in his mind the learning outcomes of the programme, which are usually read at the beginning of the programme in the programme handbook and forgotten straight after (FG1S7-5, 6). Both written reflection (FGS6-3) (FG2S5-5) and discussion with the

mentors (FG1S7-7) (FG2S3-2) (FGS6-2) (FG1S4-9, 13) (FG2S5-5) helped the students to understand which outcomes they had already achieved and which they still had work on:

“I think that talking with the mentor is good, because he makes things clearer and tells you which outcomes you still need to achieve at that stage in the courseI also did this a bit alone with reflection.” (FGS6-2, 3).

Mentors were clear that reflection was the first tool to help students to solve academic and clinical problems (IM1-1) and direct them in the achievement of the learning outcomes of the programme (IM1-3) (IM2-1) (IM3-7):

“I think that the portfolio experience makes them read the learning outcomes and understand that you have to achieve them.....I think that reflection helps them to understand what they are supposed to have achieved. I do as a mentor like to comment about that particular procedure or experience as well as what they reflect upon, so to almost triangulate the experience.” (IM2-1, 2).

One of the mentors affirmed that the mentors’ role was also important to help students to overcome their frustrations (IM1-2) caused by the fact they would like to see all the outcomes achieved.

5.3.13 The summative assessment of learning outcomes (ass/lear/out/sum)

The use of the orthodontic e-portfolio, with reflective writing and discussion with the mentors, as a tool to assess some of the learning outcomes of the orthodontic programme in a continuous way has been discussed in the focus groups and interviews.

Different outcomes were identified by students and mentors: (clinical information gathering, diagnosis and treatment planning, treatment procedures, patient management, communication, health promotion, health and safety, information handling, ethical behaviour, decision making, clinical reasoning and judgment, management of research, application basic science, professional development, personal development) but a general consensus was achieved for:

- Communication (FG1S1-12) (FG2S5-9) (FG2S3-19) (IM2-1) (IM3-1).

- Decision making, clinical reasoning and judgment (FG1S2-8) (FG1S4-16) (FG2S5-12) (FG1S3-20) (IM2-4).
- Professional development (FG1S4-14) (FG2S6-13) (IM1-7) (IM3-3).
- Personal development (FG1S4-14) (IM1-7) (IM2-5) (IM3-3).

5.3.14 Summary

In the last phase of this qualitative analysis the study findings were organized by the author. She used a chart for each objective of the study (Figure 5.5, 5.6, 5.7, 5.8) to summarize the results and to show them in an easy and understandable way.

The main heading of each chart represents one of the objectives of the study and the other headings in bold are the categories that emerged from the analysis and that are associated with that particular objective. Each chart contains several coloured boxes with different shades of the same “Basic” colour (Orange, blue, green and pink). The “Basic” colours represent the four objectives of the study with the associated categories. The statements that summarize correlated concepts are placed in boxes of the same shade. The number of students (S) or mentors (M) that agreed with a particular statement is placed in brackets in the boxes (e.g. 3S means three students; 3M means three mentors).

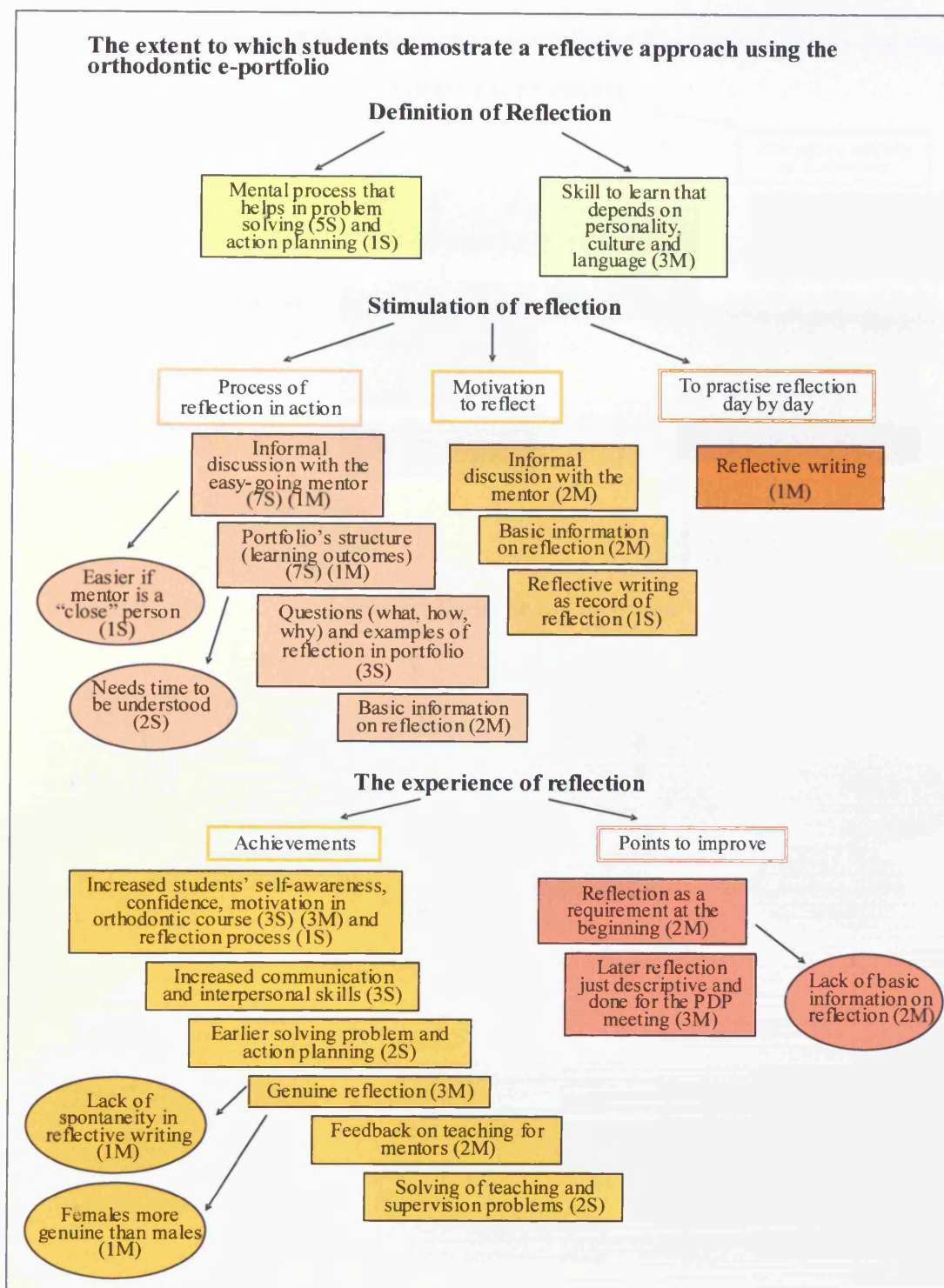


Figure 5.5: The extent to which students demonstrate a reflective approach using the orthodontic e-portfolio

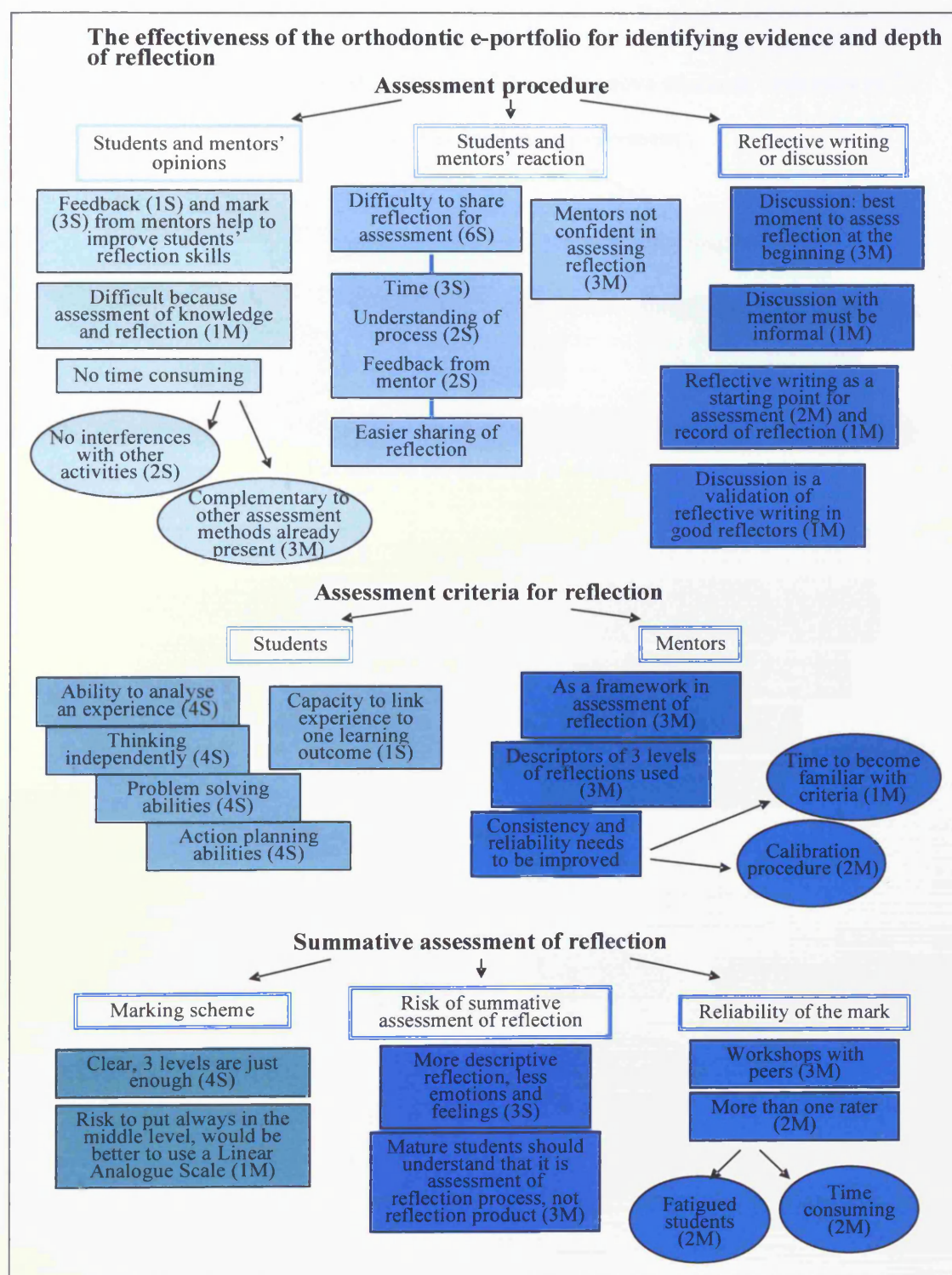


Figure 5.6: The effectiveness of the orthodontic e-portfolio for identifying evidence and depth of reflection

The effectiveness of the orthodontic e-portfolio to improve students' reflective skills

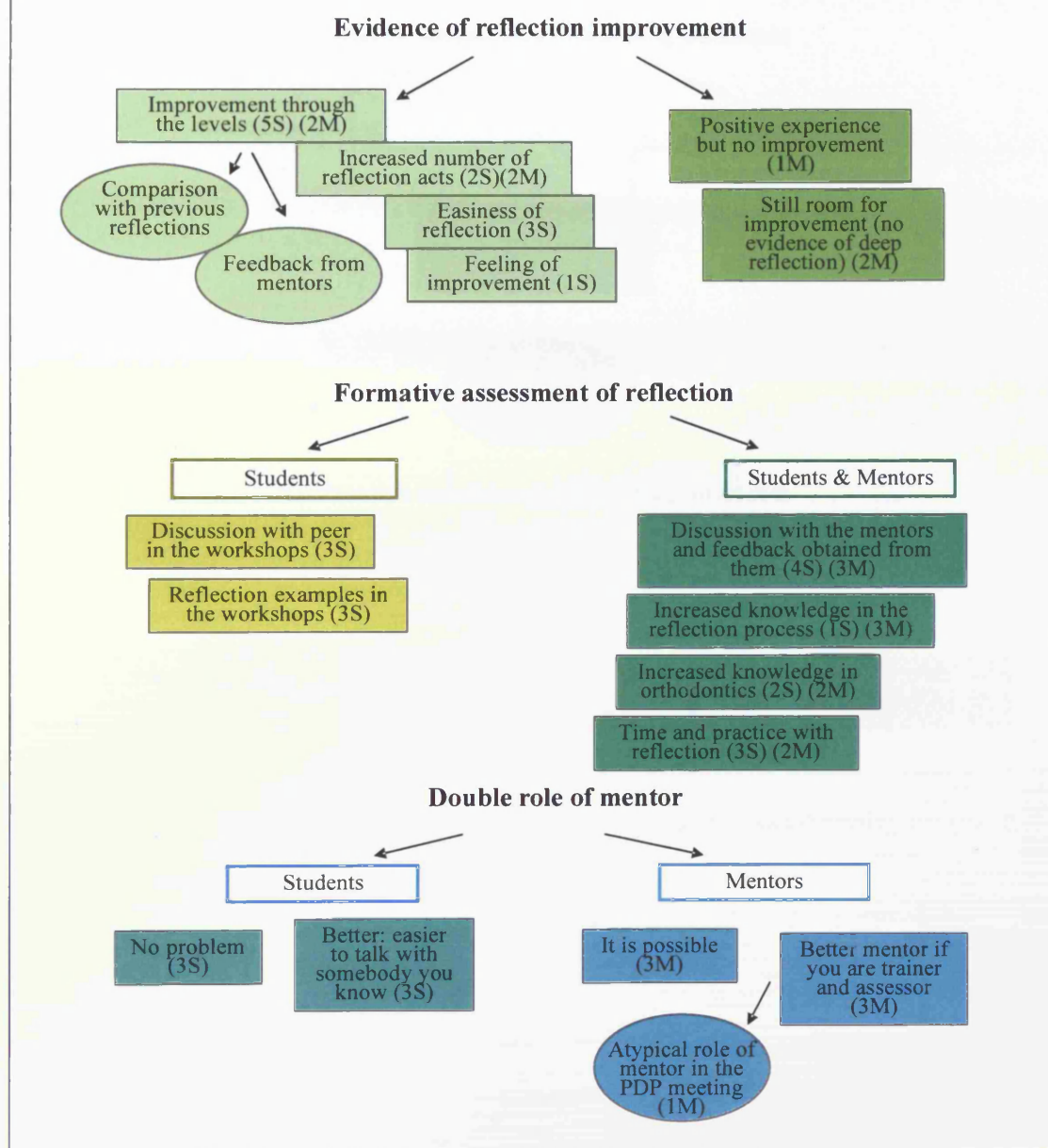


Figure 5.7: The effectiveness of the orthodontic e-portfolio to improve students' reflective skills

The effectiveness of the e-portfolio process as a summative and formative assessment of learning outcomes

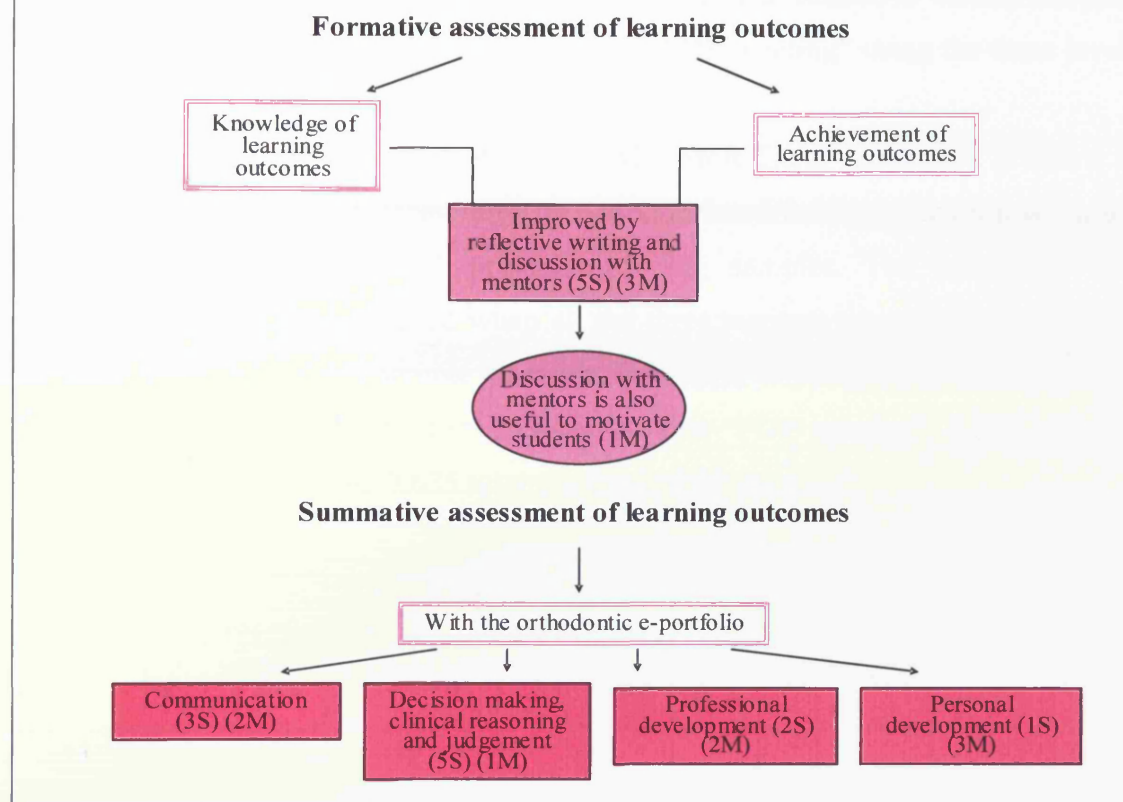


Figure 5.8: The effectiveness of the e-portfolio process as a summative and formative assessment of learning outcomes

5.3.15 The reliability of the coding scheme

The three academic mentors were asked to mark students' reflective writing samples, taken from each student's portfolio, after each "PDP meeting" using the three levels of reflection as a marking scheme.

The marks were coded and tabulated in a "Microsoft Excel" document (Table 5.1) and then the inter-judge agreement (IJA) was calculated for each occasion when the mentors marked the students' reflective writing samples. The agreement was considered to have been reached when all the three mentors gave the same score to the same reflective writing sample (in red in Table 5.1)

The inter-judge agreement was 0.125 after the first "PDP meeting", 0.375 after the second "PDP meeting" and 0.625 after the final "PDP meeting".

	After first PDP meeting			After second PDP meeting			After final PDP meeting		
	M1	M2	M3	M1	M2	M3	M1	M2	M3
S1	1	1	1	3	3	3	2	2	2
S2	2	2	1	0	2	1	2	3	3
S3	1	3	3	2	2	2	3	3	3
S4	3	1	2	1	2	2	3	3	3
S5	0	1	1	1	2	1	0	1	1
S6	3	2	3	0	2	1	2	2	2
S7	1	3	2	2	1	2	2	2	2
S8	3	2	3	1	1	1	1	2	2

Table 5.1: Reflection levels assigned by mentors (M1- M3) to each student (S1-S8) after the three "PDP meetings"

The mark "0" was used by mentors to indicate that the reflective writing sample did not meet any of the criteria used to judge reflection in the study.

5.4 Discussion

5.4.1 Results

Within the limitations of time, the resources and the experience of the author, this study represents an initial exploration of the e-portfolio relevance, as a learning and assessment tool, to an orthodontic postgraduate programme and its application to other situations should therefore be undertaken with caution.

A pilot evaluation of the introduction of the e-portfolio was conducted. The four objectives of the study were addressed by the mentors' evaluation of students' reflective writing samples and mentors' and students' observations about their experience with the orthodontic e-portfolio for one academic year. The development of a reflective approach and the improvement of students' reflective abilities and other professional skills during the one-year experience were described as outcomes of this educational intervention. Another result of this educational methodology included the possibility of using the orthodontic e-portfolio as a summative assessment tool for reflection and indirectly of personal and professional development learning outcomes and other learning outcomes.

5.4.1.1 The extent to which students demonstrate a reflective approach using the orthodontic e-portfolio

Professional education should aim at preparing professionals who can apply theoretical knowledge to practice in the real world. Reflection works very well in helping students to create a bridge between theory and practice and retains an important role in the revised curriculum of professional programmes (Brown 2001; Snadden and Thomas 1998a).

One of the mentors in the present study affirmed in the interview that reflection is “...a skill to learn...” (IM1-15, 22), but as expressed by Race (2002), reflection is very difficult or probably impossible to teach in the traditional way. This is in line with the proliferation of different tools (e.g.: diaries, journals, portfolios and reflective logbooks) to develop and improve students' reflective abilities in

undergraduate and postgraduate education for a variety of health professions (Mann et al. 2007). The orthodontic e-portfolio has been applied in the orthodontic programme in Cardiff as a tool to develop and improve students' reflective abilities.

Qualitative and quantitative studies (Driessen et al. 2005a; Driessen et al. 2003; Maidment et al. 2006a, b) showed evidence that a portfolio is an effective tool for stimulating reflection in medicine and dentistry.

In the present study the orthodontic portfolio had three components to stimulate reflection: 1) the reflective writing 2) the meeting with the mentor and 3) peer discussion. A similar approach combining structured reflective writing by students, individualized faculty feedback to those students and small group discussion was introduced in the medical school of Brown University. A qualitative analysis of medical students' evaluation of that new approach showed that it promoted deep and purposeful reflection and foster professionalism (Wald et al. 2009).

As proof that the e-portfolio in the present study stimulated students to reflect is the fact that at the end of the year almost all students gave a clear definition of reflection. Cole (2005b) affirmed that basic knowledge of reflection represented the first step towards a reflective approach. Students defined reflection as a process that helps people to become self-learners. People reflect on their own experiences pointing out the positive and negative aspects of the situation in order to spot if changes are needed for improvement. These changes represent new learning that will affect future actions. The following is an example of a students' definition of reflection:

"Reflection is a thought process you go through and think how I have done this, have I done it wrong? If it is done wrong how can I better myself and if I did it okay is there any room for improvement. You add the improvement to a filing system in your brain; you know this is how I can go about doing it next time." (FG2S6-2).

This definition demonstrates how students went through the different steps of the modified Gibbs' reflection model suggested in the portfolio to achieve new learning. The definition also highlights the relationship of reflection and learning, which several studies have already discussed (Buckley et al. 2009; Hinett 2002a; King 2002; Moon 2001, 2007; Wald et al. 2009) and supported (Boyd 2002; Grant et al. 2006; Mathers et al. 1999; Wald et al. 2009).

However, for the practising professional, the process of reflection appears to include two aspects (Schön 1983): reflection-on-action and reflection-in-action. The students' definitions of reflection seem to cover only the reflection-on-action aspect, showing that they did not use, or did not realize they used, reflection-in-action during the one year experience. This could be explained in two ways:

- information on reflection-in-action given to students before the experience was not enough;
- most of the students used reflection for the first time during the one year experience with the orthodontic e-portfolio. Reflection-in-action, usually called "thinking on your feet" (Hinett 2002a), is the most demanding type of reflection upon one's own practice and takes place during the action itself. It requires an awareness of context and the ability to evaluate progress during the course of the action and thus requires some experience in reflection (Schön 1983).

All the mentors affirmed that at the beginning of the portfolio experience, there was a lack of understanding of the reflection process by the students and reflection was only a requirement. An explanation of this could be that most of the students met reflection for the first time during the study experience and, despite the information students received before starting the one year experience with the orthodontic portfolio, they still showed doubts and uncertainties about the purpose of a reflective approach and how to reflect. However at a later stage during the e-portfolio experience students understood the purpose of reflection and how to reflect better, leading to a more conscious acceptance of the reflection process.

Other reasons to believe that the orthodontic portfolio supported a reflective approach were the answers that students and mentors gave when they were asked about what stimulated reflection during the experience.

Seven students and one mentor explained that the reflective part of the portfolio, structured so that each reflective action was linked to a learning outcome of the programme, facilitated reflection. The portfolio structure was also considered as important an factor in reflection by Driessen et al. (2005a) in the study of the

conditions for successful reflective use of a portfolio in undergraduate medical education. However Driessen et al. (2005a) also added that too much structure could become an obstacle for students with good reflective skills or who had achieved high levels of reflection, which was not the case in the present study. Three of the students added that the questions (what, how, why) and the examples of reflection in the portfolio were also helpful in guiding them in the process of reflection. Race (2002) affirmed that one efficient way of helping people both to reflect and to evidence their reflection could be to provide them with questions.

Two of the students in the present study commented that the structure of the portfolio, though facilitating the reflection process, required time to be understood before it made the reflective process easier. The findings support a previous study by Grant et al. (2003) where the impact of a medical student learning journal was evaluated in two successive years. The evaluation at the end of the second year showed a significant reduction in the level of confusion and anxiety related to keeping the diary and a students' improved ability to reflect. Students' training was considered responsible for that reduction and favoured reflection.

Another crucial factor for the effective use of portfolios aimed at stimulating reflection is regular discussion with a mentor (Driessen et al. 2005a; Driessen et al. 2003; Maidment et al. 2006b). In the present study, six students and three mentors agreed that discussion with the mentor was a good tool to help orthodontic students in the reflection process and to motivate them to go on reflecting. The following citation expresses their view:

"I think the meeting is better because sometimes talking with someone helps you say what you are thinking whereas writing does not always get it out."
(FG1S2-5).

Students and mentors in the present study described some of the factors that made discussion the best way to stimulate reflection. One of the students explained that the mentor in the discussion should be somebody close to make reflection easier, probably because students could freely express their weaknesses, strengths, feelings and emotions with somebody they knew. Two mentors and five students also commented on how the informal, relaxing, comfortable, pleasant and non-

intimidating environment of the meeting was important in stimulating reflection. Similarly, Hinett (2002b) in her study on “Improving learning through reflection” explained how creating an environment where students feel safe to reflect, to embrace challenges and accept getting things wrong as part of the process of learning was an important element to achieve reflective practice. Boud and Walker (1998) added in their study how teachers should take responsibility to create a climate in which the expression of reflection was accepted and legitimate.

Two of the mentors in the interviews defined reflective writing as another important factor in developing a good reflector, as was already sustained by Richardson and Maltby (1995). Mentors explained that it would permit students to practice reflection day by day. However they also realized that students did not write their reflections every day during the experience because of the busy orthodontic programme but only a few days before the meeting. On the other hand students expressed the opinion that reflective writing was not useful in stimulating reflection probably because most of them were foreign students and found it difficult to write in English. Henderson et al. (2003) suggested with a qualitative study that reflective writing could create resistance to reflection, due to lack of “narrative competence”.

The experience of using the reflective orthodontic portfolio for one year brought some achievement to both students and mentors. These changes might contribute to showing that there was a process of reflection and that it was stimulated by using the portfolio.

Hinett (2002a) affirmed and different studies (Mathers et al. 1999; Wald et al. 2009; Wessel and Larin 2006) supported that reflection promotes the development of some skills that are all important abilities for achieving personal and professional development learning outcomes. Four students and three mentors in the present study affirmed that the act of reflecting increased students’ self-awareness, confidence and motivation in the orthodontic programme and in the reflective process as well. Furthermore, three of the students noticed that during the experience with the portfolio there was an improvement in their communication and interpersonal skills due to the interaction with mentors and peers.

King (2002) in her study “Development of Student Skills in Reflective Writing” expressed that there were a variety of outcomes (such as, development of a theory, the formulation of a plan of action, or a decision or resolution of some uncertainty) that can be expected using reflection.

In the present study, two of the students explained how during the experience with reflection they found that they could solve their problems earlier in the programme and organize a plan of action for the future as shown in the citation:

“I think the reflection process helps to highlight some issues or problem avoiding sweeping them under the carpet and forgetting about them. It helps to bring up the issue earlier on and to not postpone it until you regret.”(FG1S8-1).

O’Sullivan et al. (2004) supported the fact that one of the goals of a reflective approach was to provide feedback regarding the programme for curriculum improvement and indeed evidence of reflection in the present study was also the feedback on the programme organisation that mentors received during the one year experience.

Two students pointed out that reflection with the mentors was a good moment to discuss teaching and supervision problems. The improvement of these aspects of the curriculum during the year was witnessed in the process of reflection during the meeting with the mentors.

Hinett (2002b) affirmed that falsifying, copying or downloading reflective material is problematic since it needs to fit not only with the experience and evidence provided but also with the values, opinions and previous reflections of the individual. Along the same line mentors were very confident that students’ reflection was genuine. However mentors added that the genuineness of reflection could be influenced by some factors, such as gender and reflective writing, as shown in the citations:

“Regarding genuineness I think females make better reflections than men, in my experience, so I was very comfortable with the genuine nature of the girls.” (IM2-12);

“You write down what you are prepared to let people see which may not necessarily be what your reflection was at the time.” (IM3-13).

5.4.1.2 The effectiveness of the orthodontic e-portfolio for identifying evidence and depth of reflection

The increasing recognition of the benefits of reflection for health professionals has led to the introduction of specific assessment tools for reflection. The “PDP review” (reflective writing) and “PDP meeting” (discussion) were the tools used in the present study by mentors to formatively assess students’ reflective abilities on the basis of portfolio evidence. They were formative tools of assessment but with the intention of evaluating a possible summative use of them in the future.

It is still debatable if a formal assessment of reflection is needed and possible. Studies through the years, have shown that reflection can be assessed with valid and reliable methods (Boenink et al. 2004; Burnett et al. 2008; Kember et al. 1999; Ker et al. 2003; Wong et al. 1995). On the other hand Sumsion and Fleet (1996) found a low level of inter-rater reliability in their study and concluded that reflection appeared unsuited to quantitative measurement and easy and reliable rating scales were not effective in discerning different levels of reflection. However Kember et al. (1999) explained that the categories of reflection used by Sumsion and Fleet (1996) in their study were not as well defined as they had claimed and they did not explain in which way inter-rater reliability was counted.

All the studies cited above applied the reflection assessment tool in the undergraduate professional programme and evaluated it using a quantitative approach. In the present study the assessment of reflection was used for 1st year postgraduate orthodontic students and was evaluated principally using a qualitative approach.

The assessment of reflection in the present study was considered positively by students and mentors. They did not consider it as a time consuming experience interfering with their activities.

Six students found it difficult, particularly at the beginning, to offer their reflection and deep reflection with emotions and feelings for assessment. However with time, more understanding of the process, which was possibly obtained during the workshops with peers and the researcher, and help from the mentors during the “PDP” meeting, it became easier particularly during discussion.

The students' initial feelings of uncertainty and resentment towards the reflective component of the portfolio and their improved attitudes, particularly after the initial year, have also been found by Davis et al. (2009). They used a questionnaire containing statements and open questions to obtain feedback from students in order to identify and analyse students' attitudes to the portfolio assessment process over a period of time. Similarly to the present study, the reasons for the students' improved attitudes towards the reflective component of the portfolio in Davis et al. (2009) were the introduction of the student induction process on reflection and changes in the mentoring programme.

Three mentors considered the assessment of reflection as a complementary form to the assessment methods already present in the orthodontic programme in Cardiff. They were not really confident at the beginning because the assessment of reflection was something new; for example one of them started judging the product of reflection together with the process of reflection. This is in contrast with Moon (2002a) who maintained that what is assessed in the assessment of reflection should be the process of reflecting and not the outcomes obtained from the reflective process. However at the end of the experience mentors could cope better with the assessment of reflection, probably because the practice with assessment and the workshops with the colleagues made the outcome of assessment clearer as expressed below:

"..... if they reflect on it well then they get a high score. So it is not to do with whether they are good students or bad students or whatever, it is whether they can reflect or cannot." (IM2-8).

A debate exists regarding how the summative assessment of reflection can affect students' reflection. Pee et al. (2002) explained that a mark might result in apprehension amongst students that could prevent them from engaging with and learning from their experience, perhaps even inhibit the development of the qualities and skills required for reflection. Richardson and Maltby's (1995) findings showed that assessment of reflection could inhibit the development of reflection but they affirmed that without assessment, students might be unwilling to engage in reflective activities. In the present study, three students affirmed that the use of a summative assessment of reflection could lead them to be more descriptive in their reflection

and express less emotions and feelings. On the contrary three other students said with regards to the assessment of reflection:

“...and then if there is a mark, yes I would try a little bit harder in order to do better.” (FG1S5-9).

These latter three students also pointed out that they would like to receive the mark and the reason for it at the end of the meeting with the mentor (instead of later in the week) to obtain the most from the assessment process.

Furthermore the mentors explained that if the meaning of reflection assessment had been well understood, there was no risk that a mark could affect student's reflection, as already pointed out by Richardson and Maltby's (1995). The mentors also added that postgraduate students, like those in the present study, should be able to understand what they were judged on properly.

Another doubt in the literature raises concerns about which representation of reflection, written or in discussion; a student should be judged on. In the majority of studies the authors concluded that reflective writing could be used to demonstrate the presence or absence of reflective thinking (Boenink et al. 2004; Burnett et al. 2008; Kember et al. 1999; Ker et al. 2003) but Hatton and Smith (1995) proposed verbal interaction as another way of judging reflection. Wong et al. (1995) demonstrated that using text analysis to assign nursing students to broad reflective levels gave results consistent with interviews. Korthagen (1993) affirmed that individual and small group discussion seemed the most appropriate strategies for recognising different forms of reflection. However Sumsion and Fleet (1996) underlined how these strategies might not be applicable when large numbers of students were involved.

In the present study, reflection was assessed both from reflective writing (“PDP review”) and discussion (“PDP meeting”), considering that the number of students on a postgraduate programme is usually not large. All the mentors affirmed that discussion was the best moment to assess reflection and deep reflection especially at the beginning of the students' experience, as cited:

“Making a judgement of the reflective writings is different than making a judgement when you have had the statements from the student and you have also the student there. There is that interaction which may make things different.” (IM3-11).

Reflective writing favours low levels of reflection whereas reflection in discussion helps the inexpert and leads to high levels of reflection. One of the mentors concluded by saying that discussion could be the validation of a student's reflective writing only in the case of a good reflector. Mentors added that the presence of many foreign students in the present study contributed to making discussion the best moment to assess reflection. Students' writing may have been inhibited by their personality and language and interaction with mentors might have helped students to reflect.

Regarding the reflective writing judgements one of the mentors affirmed:

“It took me a while to begin to work through distinguishing between whether writing a lot meant they were better or whether the words they used were more succinct and therefore a better reflection.” (IM2-11).

The assessments of students' reflection done on the basis of their writing might not be accurate. Concerns focus on the difficulties involved in differentiating between when students are reflective but this cannot be detected in the text, or when students are not reflective but can write in a style which is generally recognised as reflective (Hatton and Smith 1995; Sumsion and Fleet 1996).

However Hatton and Smith (1995) explained that reflective writing should be judged in terms of criteria for the recognition of reflection, not in terms of standard academic writing conventions.

The validity and reliability of the summative assessment of reflection are important factors to aim for in its final administration.

The PDRA instrument, developed by Ker (2002) to assess reflective written material, has been used to assess reflection in the present study. The validity of the PDRA for a portfolio involved in assessing professional development has been demonstrated by Ker et al. (2003). The reliability of PDRA was showed by Burnett et al. (2008).

In the present study reflection in writing and discussion was assessed using the PDRA instrument because of the evidence provided by Wong et al. (1995) that there

was consistency between these two methods to express reflection. The marking scheme consisted of three categories that worked as a framework for defining the levels of reflection. Each category was described by a sentence that explained what a student should do to achieve the corresponding level of reflection. In the focus groups and interviews, four students and two mentors affirmed that the three categories present in the marking scheme were well defined and sufficient to assess reflection. One of the mentors affirmed that three levels were too few to discriminate different students' reflective abilities and there was a tendency to always put students into the middle band. He suggested that a Linear Analogue Scale would have been a better way to mark reflection; however there could be always a tendency to put people in the middle band.

What constitutes a good and reliable assessment of reflection was considered both during the implementation, as part of the curricular alignment (Manogue and Brown 2007), and the evaluation of the assessment approach used in the present study.

Detailed criteria, clear to students and assessors, are necessary for each form of assessment in order to guide the work of students and assessors and to improve validity and reliability of the assessment method (Moon 2001). The appropriateness of the criteria used in the present study was evaluated in a qualitative way. When students were asked if they knew what they were judged on during the assessment of reflection (during "PDP review" and "PDP meeting") they answered differently: "ability to analyse an experience", "thinking independently", "starting the process of problem solving" and "planning for improvement in the future". All these concepts are important elements of the reflection process, but students seem to have missed the relationship among the different steps of the reflection process and how to use the evidence in the portfolio to show their reflective abilities for assessment. This was expressed in the three levels of reflection used as criteria in the present study, thus probably more time should have been spent on explanation of the criteria during the students' induction. More guidance will be necessary for students in the future both through the induction and the discussion with the mentors. On the other hand, three mentors understood the reflection criteria better and affirmed that they were useful as a framework in assessment of reflection. The citation below shows that mentors used

the definitions of the three levels of reflection as criteria to judge students' reflective abilities:

“ They (criteria) allow you making a judgement about how well they are able to reflect and they also allow you saying how well they are using the evidencethe “because word”this is one of the strengths of these criteria. I also think it is helpful for the students to understand those criteria as well. ” (IM3-4).

Mentors met their own students three times to assess reflective skills during the one-year experience with the orthodontic e-portfolio, ensuring the repeatability of the measurement. After each set of meetings with their own students, the mentors all received the same samples of reflective writing taken from the students' portfolios and they were asked to mark each sample using the three levels of reflection. Then the mentors met with the researcher three times during the year to compare the marks they assigned to the reflective writing samples and to discuss reflection and its assessment. Mentors explained in the interview that the meetings with the researcher were very useful to improve their own motivation in the experience using the portfolio, their knowledge of reflection and their familiarity with the marking scheme leading a positive effect on the credibility and dependability of the assessment of reflection.

Different tools used to assess reflection, including the one in the present study, have been proven to be reliable using appropriate tests (e.g. Cronbach alpha, the t-test, Cohen's kappa). However the changes over time in the value that indicates reliability have not been investigated, despite the fact that they could provide important information on the process of calibration needed before implementation of an assessment tool for reflective abilities.

The reliability of the marking scheme used in the present study was analysed in the marking exercise using the inter-judge agreement (IJA) approach, as previously done by Wong et al. (1995). The inter-judge agreement (IJA), calculated for the three times the mentors marked the students' reflective writing samples during the year, showed an improvement of the inter-judge reliability from 0.125 after the first “PDP meeting” , 0.375 after the second one to 0.625 after the last one. The values of IJA obtained in the present study were not high enough to consider the application of the

PDRA in Cardiff as a tool for summative assessment of reflection. This is confirmed by the mentors' comments in the interview, affirming that they should be properly calibrated for the criteria of reflection and the marking scheme before using them in Cardiff. The exercise of calibration should be done with a greater number of reflective examples. In the present study mentors marked eight samples of students' reflective writing after each meeting. After grading the reflective examples, mentors should see how close they were in the scoring, and then they should look at the outcome, and discuss and agree on grades.

Another important point to consider is that there were three mentors that judged the students in the present study, but each student received the mark from only one of the mentors. Mentors in the interview suggested that each student should be marked by more than one rater to increase reliability of the assessment method, although they recognized that this would be time consuming. Furthermore, there is a requirement of many universities for double marking of any high-stake assessment.

On the other hand Sumsion and Fleet (1996) cited that if an instrument was to be used to identify reflection, there might be more consistency if only one rater was involved, rather than averaging the ratings of several markers. They continued by saying that the disagreement over marking resulted from the fact that reflection was dependent on a high degree of interpretation, as subsequently supported by Kember et al. (1999). Furthermore, the mentor is probably the person who knows the learner best and, as a consequence, he/she can interpret his/her own student's reflection better than anybody else, both in writing and in discussion, improving the credibility of assessment (Kember et al. 1999).

A calibration of the mentors for the criteria of reflection and the marking scheme before using them for future studies, as already suggested above, could increase the dependability without the necessity to have more raters for each student.

5.4.1.3 The effectiveness of the orthodontic e-portfolio to improve students' reflective skills

Duke and Appleton (2000) supported in a quantitative research involving reflective writing assignments in nursing that reflection was a skill to be learnt and was

developmental. They illustrated an overall improvement in the degree to which students were able to achieve the reflective skills assessed. However the quantitative study of Duke and Appleton (2000) did not illuminate how reflection development was achieved and what facilitated and discouraged it.

The orthodontic e-portfolio with its associated activities (discussion with mentors and peers) might be a useful tool for the improvement of students' reflective abilities over time. The presence of students' reflective skills improvement and the reasons for it have been investigated principally in a qualitative way in the present study.

Four students affirmed that the experience with reflection for one year resulted in an improvement of their reflective skills and this was evident in the quality of reflection, the ease of the reflection process, the number of reflective actions at the end of the year in comparison with the beginning of the experience.

Two of the mentors also saw an improvement of reflection through the levels and in the number of reflective actions as shown in the following citation:

"I think they started off not knowing what to write. You know, they would normally put things that they thought they have done badly, because they thought that was what coming to see the mentor was about; being told off for not doing things as well as they should....they improved on their ability to be reflective over the period of time, both in the breadth of what they have said about and the number of things they have reflected upon. So they have done it more often and deeper." (IM2-4, 6).

Mentors affirmed that at the beginning of the experience, students only described the evidence they had collected in the portfolio. Later, they carried on at least managing descriptive reflection and starting to reflect to higher levels.

Previous studies (Pee et al. 2002; Powell 1989; Richardson and Maltby 1995), despite some issues regarding the validity and reliability of the method used, highlighted in a quantitative way that reflectivity was mainly at a low level and critical reflection was harder to achieve.

In the present study the improvement of students' reflective abilities can be observed quantitatively in the tabulation of the marks mentors gave to reflective writing samples. The marking system used for judging comprised of three levels of reflection, from a more descriptive (level 1) one to a more reflective one (level 3).

Level 1 (25) and level 2 (31) were more represented than level 3 (13). There were more level 1 marks in the first part of the orthodontic e-portfolio experience and more level 2 and level 3 marks in the second part. Level 2 of reflection was the most frequent mark awarded. This might be in agreement with the fact that a small odd number of levels of reflection could influence the rater to use the middle one as suggested by one of the mentors in the present study.

These observations have little value considering that the mentors were not expert in judging reflection and that they were not able to differentiate consistently between the reflective skills assessed, particularly at the beginning of the experience. However in the present study reflective abilities were evaluated not only once, as in the studies cited above, but three times in the same sample during the experience with the portfolio. Multiple evaluations should better underline the changes of reflective skills over time.

If reflection is developmental there should be different variables that influence the depth of reflection. Wessel and Larin (2006), in a study with undergraduate physiotherapy students, showed that the improvement in reflective writing from the first to the third clinical placement was dependent on a good facilitator (faculty) and trust development between educators and students. In accordance with Wessel and Larin (2006), five students and two mentors in the present study affirmed that the discussion with the mentor during the meeting and the feedback obtained were reasons for the improvement of reflective abilities as shown in the following two citations:

“I certainly did improve and I think it was the one to one discussion with the mentor that caused most of this improvement....I mean the good feedback on reflection from the mentor.” (FG2S3-6);

“The best thing, it is the meeting with the mentor because through the mentor you know where you are when you begin to reflect and how to improve your reflective skills” (FG1S4-13).

In addition, six of the students affirmed that the workshops with the peers and the researcher during the experience, where they discussed the reflection experience so far and looked at the reflective writing examples, were a good way to improve their reflective abilities. As quoted above, this is in line with the results of the qualitative

analysis of an evaluation by medical students of a new tool to improve reflection by Wald et al. (2009). They highlighted the improvement of students' reflective writing by means of student discussion, in small groups, of their own reflective writings. However during the workshops in the present study students also received reinforcement of the process and stages of reflection through the researcher. This could also have contributed to reflection improvement as expressed by King (2002) in her study on reflective writing improvement and by three students and three mentors in the present study.

Time for reflection and practice with reflection, as supported by a previous study (King 2002), were considered other reasons of improvement by both mentors (2) and students (3), for example:

"I think they are developing a reflective approach. I do not think it is coming naturally; I think they have to work quite hard to develop this approach. One of them certainly has had experience of reflective writing during her undergraduate course and she seems to be one of the better reflectors." (IM3-1).

Three students and three mentors supported the idea that the improvement of reflective skills went with the same speed as the increase in knowledge of the orthodontic topics and clinical tasks as shown below:

"I think there was an improvement. I think the improvement was partly because they began to understand more why they were doing it, but also partly it was due to the fact they are now coming –up to one third of the way through a three years programme and they began to understand more about orthodontics." (IM2-1, 2).

The reflective process has a positive impact on learning and clinical practice, as already reported (Boyd 2002; Grant et al. 2006; Mathers et al. 1999; Paget 2001). The data from this study suggest that the corollary also exists: the improvement in the reflective process by the student is promoted by the continued development of their knowledge and clinical skills in orthodontics.

Along the same line, affirming that the reflections of senior students and clinicians were different from students beginning their clinical experience, were Boenink et al. (2004) and Wessel and Larin (2006). On the contrary Wong et al. (1995) and Paget (2001) showed in their studies that experience and/or academic

level did not appear to have an effect on the level of reflectivity. However Wong et al. (1995) and Paget (2001) evaluate reflection only once in their study.

Three of the mentors said in the interview that reflection depends partly on personality, culture and language and this could explain why different students achieved different levels of reflective ability during the one year experience with the portfolio, for example:

“....partly from the culture they come from, they have not got that reflective approach to analysing the performance. They are used to doing what they are told and then learning by just doing what they are told rather than critically analysing the performance.”(IM2-1).

A similar concept has already been supported by the views of experienced medical teachers, obtained in semi-structured interviews, on the conditions for successful portfolio use. They affirmed that ability, attitude and motivation determine how easily students learned to reflect (Driessen et al. 2005a).

Finally one of the mentors affirmed that during the experience with the portfolio and the meeting with the students, he had the impression that women were better reflectors than men. On the same line Boenink et al. (2004) showed that women had slightly (not significantly) higher scores than men in their quantitative studies.

5.4.1.4 The effectiveness of the orthodontic e-portfolio as a summative and formative assessment of learning outcomes

In the present study, the portfolio was used as a formative tool, with the intention that it could, in the future, also be used in a summative manner for assessment of some learning outcomes of the orthodontic programme.

There are still doubts in the literature about whether the portfolio could be used for formative and summative assessment concurrently. Driessen et al. (2005a) and Mathers et al. (1999) showed that the use of a portfolio for summative assessment could be successfully combined with its use for learning both at the undergraduate and postgraduate level. On the contrary, McMullan et al. (2003) concluded in their literature review that when a portfolio becomes an assessment tool, it loses its

learning value. Two qualitative studies (Kjaer et al. 2006; Snadden et al. 1996) also showed the conflict in using the portfolio both for learning and assessment but Kjaer et al. (2006) supported a possible way to overcome it dividing the portfolio in a private and a public part.

All the students in the present research affirmed that the experience with the portfolio helped them to keep clear in their mind the learning outcomes of the programme. These findings are supported by Davis et al. (2009) who evaluate students' reactions to the introduction of portfolio assessment in Dundee Medical School. Students perceived the portfolio process (building and assessment) supported their learning and heightened their understanding of the institutional learning outcomes. However in the study of Davis et al. (2009) students thought that building the portfolio was time consuming but it did not happen in the present study.

Students and mentors affirmed that both self-reflection and discussion with the mentors were two important moments for analysing which outcomes they had already achieved and which they should still work on. This finding is in accordance with the qualitative study of Ellis et al. (2006), but they only considered tutors' opinions on the issue. On the other hand one of the mentors in the present study affirmed that mentors' support during the "PDP" meeting was only useful in terms of students' assurance and motivation.

Students and mentors supported the use of the orthodontic portfolio components (reflection writing and discussion with the mentors) as a tool to assess in a summative way some of the learning outcomes of the orthodontic programme such as communication, decision making, clinical reasoning and judgment, professional development and personal development. These findings are supported by previous studies that suggested portfolios could be used to assess aspects of the curriculum such as personal and professional development (Gordon 2003) and communication skills (Rees and Sheard 2004a; Rees and Sheard 2004b) but they did not consider both mentors' and students' opinions as is happened in the present study.

There is benefit to be gained from triangulating the portfolio with other assessment methods (Melville et al. 2004; Tochel et al. 2009). The need for the triangulation of a portfolio was confirmed in the present study, where it appeared that the evaluation of students' reflective skills through the portfolio indirectly represented the assessment of certain learning outcomes (professional development and personal development) that would be assessed with difficulty with any other form of assessment.

Driessen et al. (2005b) and Tartwijk and Driessen (2009) affirmed that the mentor's combined role of supervisor and assessor could be difficult and needed training sessions for mentors. Students and mentors in the present study positively accepted the fact that the mentors were also assessors. Three students found it easier to express reflection for assessment with somebody they knew well, as a mentor. All the mentors affirmed that they could help students to reflect better if they were trainers and assessors.

5.4.2 Research methodology

A "mixed methods" design (Cresswell 1994) of research has been chosen in this study. Both qualitative and quantitative methods were applied simultaneously to better understand the experience of using the orthodontic e-portfolio as a tool for assessment of reflection, professionalism and learning outcomes.

Pee et al. (2002) maintained that students' opinions alone were not sufficient to evaluate students' reflection using a portfolio and he proposed the examiners' evaluation of the student's reflective writing as a better method. In the present study, both students' and mentor's perceptions were collected for analysis together with the students' reflective writing samples marked by the mentors.

Students and mentors, who were selected by a "critical case sampling" technique, were able to give opinions and impressions on the effectiveness of the orthodontic e-portfolio as a formative and summative assessment tool after the one year experience with the orthodontic e-portfolio approach. The sample contained only a small number of participants. However the aims of this study were to derive as much

information as possible from the orthodontic e-portfolio experience (Silverman 2005) and provide a clear, detailed, and in-depth description of the research methodology that might help others to decide the extent to which findings from this research are applicable to other situations (Schonfield 1993).

The author met with the mentors and also with the students three times during the year to assist with the collection of impressions and information over time in order to create appropriate questions for the interview and the focus group framework. Interviewing individuals more than once can lead to a change in the framework of the succeeding interviews and focus groups (Shenton 2004), to an increase in the depth of response from participants, to an investigation of early trends and to an assessment of changes in the variables of interest over time. In the present study, mentors and students were interviewed only once because of time restrictions. However interviewing participants only once led to a reduction in the number of interpretations that made it easier to find the convergence of results.

The values of inter-judge agreement (IJA), that showed an improvement of the inter-rater reliability, were calculated for the three times the mentors marked the students' reflective writing samples during the year. It was considered that agreement had been achieved when all the three mentors gave the same score to the same reflective writing sample but if the number of reflective writing samples had been greater a more accurate analysis of reliability would have been possible.

On the basis of the evidence brought by Wong et al. (1995), the inter-judge agreement was calculated only for the marking of reflective writing whereas in the one-year experience with the portfolio, mentors marked students' reflective abilities both from reflective writing and discussion. However in the present study discussion resulted as the best method to assess reflection and this should be taken into consideration for future studies. The exercise of calibration proposed by the mentors in the interviews should be done including both reflective writing and discussion. The problem of calibrating mentors to assess reflection in discussion is that students could give different answers in discussion with each different rater leading to decreased reliability. A possible solution would be to video record one or more discussions between a student and his/her own mentor and to show the recordings to

the different raters for marking. Consent from the students should be taken before using reflective writing or discussion samples for a calibration exercise.

Different methods were used in the qualitative part of this study to improve rigour together with the detailed description of the qualitative research design and data analysis applied (Barbour 2001).

5.4.2.1 Triangulation

Method and source triangulations (Patton 1999) were used in this study in order to increase the range of perspectives possible and credibility.

The author collected data during the study through focus groups with the students and through interviews with the mentors in order to obtain a deeper understanding of the study topic (Grbich 1999b). A one-to-one interview with each mentor revealed their personal opinion of the e-portfolio as an assessment tool for reflection without the influence of other mentors. On the other hand, the focus group was considered more appropriate for students who were stimulated to express their opinion more freely through the interaction with others in a group. Furthermore, the author combined qualitative with quantitative methods in this study in order to answer complementary aspects of using the e-portfolio as an assessment tool. The qualitative method enabled analysis of students' and mentors' opinions on the e-portfolio experience whereas the quantitative method showed the changes over a period of time of students' reflective abilities and of the reliability coefficient used for the tool to assess reflection.

The author decided to use both students and mentors as information sources about the e-portfolio experience in order to achieve a more holistic view of the data. The mentors could give their opinion on the method used for assessment of reflection whereas students could express their impressions and feelings with regards to being assessed on their reflective skills.

5.4.2.2 Respondent Validation

The author has not used participant validation as a tool to assess the quality of this study because of the multiple limitations associated with this method as seen in the literature (Barbour 2001; Holloway and Wheeler 2002) and particularly:

- time commitment from both the researcher and the participants;
- mentors might modify ideas and concepts disclosed during the interview because of temporal effect or changes in their situation;
- it would be difficult for the students to confirm on the transcript what they said during the focus group without being influenced by what others said;
- no agreement among different participants on the data analysis.

5.4.2.3 Multiple coding

Armstrong et al. (1997) affirmed that it is improbable that different researchers (multiple coding) would analyse and interpret the data in the same way. The greatest potential of multiple coding lies in its capacity to furnish alternative interpretations alerting researchers to all potentially competing explanations. However, multiple coding was not used in the present research because:

- the same researcher can also obtain different interpretations of the same data;
- if different researchers analysed the data, they should also participate in focus groups and interviews.

5.4.2.4 Negative cases or alternative explanations

The author sought alternative explanations to the data collected by considering the cases that did not fit within the main interpretation in order to refine and complete the emerging findings and increase the credibility of the study method (Holloway and Wheeler 2002).

5.4.2.5 The audit trail

Since the methods used in research, the context in which the research is carried out and the researcher all unavoidably influence the findings (Mays and Pope 1995, 2000; Patton 1999), the author decided to apply all four types of Audit documentation, classified by Rodgers and Cowles (1993), in order to increase credibility and dependability and to highlight the transferability of the study results.

The author has given a clear account in this chapter of the following elements to enable further external checks. She has described herself, her background and competence (personal response) and the participants and the location of the research (Contextual Audit). She has also given detailed information on the sampling process, the process of data collection (Methodological audit) and the process of data analysis (Analytical audit). Furthermore, the use of citations with their own transcript identifier in the description of the results allows the research report to be checked confronting the actual data collected.

Chapter 6 Conclusion

In the first part of the research a modified Delphi technique was applied in order to improve staff collaboration and curriculum alignment in the orthodontic specialist training programme in Cardiff. Similar and different views, regarding learning outcomes and assessment methods, held between different staff members involved in the revision of the curriculum were explored using two successive questionnaires.

The Delphi process, which was used to refine and validate a list of outcomes and their appropriate assessment methods based on the literature, led to a consensus of staff members' opinions of 98.4%. The panellists' judgment identified which of the literature based learning outcomes for an orthodontist and their assessment are important and feasible in Cardiff.

In the final list, which is organized in accordance with the three circle model for classifying learning outcomes by Harden et al. (1999a) and assures flexibility in the curriculum, each learning outcome is associated with one stage of the students' professional growth (Novice, Beginner, Competent, Proficient, and Expert) for each year of the programme. This facilitates the evaluation of the learning outcomes using the appropriate assessment methods for each level, identified with the Delphi process, in an integrated approach to assessment (Hager 1995).

The Delphi process was effective and could be applied again in the context of the postgraduate orthodontic programme in Cardiff in order to define the other components of the curriculum, such as the content and the methods of teaching and learning. It could also be used in the context of other professional programmes as a technique to improve staff collaboration and curriculum alignment. However the experience with the two rounds of the Delphi process in Cardiff was time-consuming. The reasons for this were the fact that the time-scales for return of the questionnaires were too long and that the subject was difficult and required an induction. Ideally a meeting among the panellists before the two rounds of the Delphi, which could introduce the topic and increase the motivation of the panellists in compiling and returning the questionnaires, may have facilitated the process.

The method used in this first part of the project could be of relevance to all those involved in the development of convergence of outcomes and their assessment for the specialist orthodontist in Europe, as previous studies showed in the medical context (Burke et al. 2009; Rohan et al. 2009). Consensus on a list of outcomes and their assessment for the European orthodontist would provide a basis on which to structure a European approach, facilitating free movement of orthodontists and safeguarding the health and safety of the patient (Bologna Declaration, 1999). However the international panel needed in a European context would make consensus more challenging and a face-to-face induction on the subject more resource demanding.

Within the present research study, the resultant list of learning outcomes and their appropriate assessment methods supported the development of a portfolio to be used in the postgraduate orthodontic programme in Cardiff. The orthodontic portfolio, which was developed using information from the literature, was electronic, structured on the agreed list of learning outcomes and with a reflective component called PDP. It aimed to facilitate formative and summative assessment of reflection, personal and professional development learning outcomes (professionalism) and other learning outcomes.

In the second part of this research the orthodontic e-portfolio was piloted for two months. Students' and supervisors' views on the portfolio's format, content, structure, IT component and on its impact on learning were collected since previous studies had highlighted some acceptability problems with portfolios' use (Davis et al. 2009; Driessen et al. 2007b; Duque et al. 2006; Gardner and Aleksejuniene 2008; Garrett and Jackson 2006; Kjaer et al. 2006; Pee et al. 2000; Ranson et al. 2007).

Both the quantitative and the qualitative analysis of the results showed that the orthodontic e-portfolio was better accepted by supervisors than by students as a learning and assessment tool. Although the majority of students and supervisors agreed that the learning outcomes in the e-portfolio helped students with direction in learning, students affirmed that building the e-portfolio did not help them in the indirect achievement of personal and professional development learning outcomes.

Most of the students did not mention the fact that the orthodontic e-portfolio, with reflective writing and discussion, could be a useful tool for developing reflective skills. Only one of the students and four supervisors described the orthodontic portfolio with supervisors' feedback as a tool to promote reflective abilities. Both students and supervisors agreed that a certain level of experience and training with the e-portfolio would be needed to see its possible positive impact on students' reflective learning and students' achievement of learning outcomes. In contrast to students, supervisors believed that the portfolio could also be used as an assessment tool for reflection and learning outcomes, provided the dynamics of assessment and the criteria were made clear to students and supervisors.

Both students and supervisors showed concerns about technical difficulties and time management during the experience with the e-portfolio. Students pointed out that a lot of writing was required. Supervisors agreed that the instructions and information received were insufficient and, with students, they recognized the importance of the supervisor's role in the portfolio building. The e-portfolio in the Blackboard platform was considered more flexible than a paper one but the software used was too complex and time consuming. The use of a PDA and a "foldable" keyboard in the workplace was considered impractical within current structures due to the clinical workload, the interface limitations and the time required for typing and for the process to be completed. These issues have been already highlighted in previous studies (Garrett and Jackson 2006; Rohan et al. 2009) supporting the view that PDAs are better used in a clinical environment as tools to surf the internet and obtain clinical useful information rather than for reflection in a portfolio context.

These students' and supervisors' perceptions in respect to the orthodontic e-portfolio's introduction have already been reported in previous studies (Davis et al. 2009; Ellis et al. 2006; Gardner and Aleksejuniene 2008; Kjaer et al. 2006; Snadden et al. 1996). They were probably partly related to the students' and supervisors' unfamiliarity with the concept of reflection and the building of an e-portfolio, to some characteristics of the orthodontic e-portfolio and to the short, two-month pilot study.

Important characteristics related to four aspects of the orthodontic reflective e-portfolio emerged from the two months pilot study. They were used to develop a framework for the future e-portfolio development in Cardiff:

E-portfolio as tool for learning and assessment. The portfolio structure should be based on the learning outcomes of the programme, which should be understandable and cover the entire orthodontic programme in order to help students in self-learning. The portfolio should have a “PDP meeting” because it should stimulate reflection by means of students’ reflective writing and discussion with the supervisor. Clear criteria should be provided if the portfolio is used as an assessment tool.

E-portfolio format and content. The portfolio should be embedded into the programme taking into consideration students’ and supervisors’ activities and avoiding repetition. Paperwork should be kept within manageable limits and other forms of evidence should be involved to show achievements of the learning outcomes. The supervisors’ feedback should support students’ portfolio building and the minimum number of formal meetings between students and supervisors should be three per year.

The IT portfolio component. The portfolio should be electronic. Suitable software should be used to prevent the process of collecting evidence and organizing it becoming too complex and time consuming, especially in cases of low IT competence. A web-based PDA that allows collecting evidence in different ways (audio, video and text) (Centre_for_Excellence_in_Teaching_and_Learning 2005), could increase its acceptability as a tool for reflection and assessment in a busy clinical environment.

E-portfolio guidelines. Clear written and oral instructions on the portfolio purpose and structure are needed, as well as more information on the reflective component of the portfolio. More specific and individual training on how to use the portfolio and its IT component would be helpful in allaying students’ and supervisors’ concerns over portfolio building and assessment. This could be in the form of an induction process and support during the experience.

However, as previous studies have highlighted and the results of the first pilot study have confirmed, the implementation of a reflective e-portfolio in a professional programme is a complex process that leads to acceptability problems. Changes in the

portfolio's structure, format and contents are not sufficient. Time, supervisors' and students' training, continuous support and a considerate amount of change in the context are necessary for the success of a reflective e-portfolio implementation in a professional programme. Institutions, considering such an implementation, should be ready to change and should abandon the old paradigms in order to create a climate where the concept of reflection is accepted and well understood.

The framework for the orthodontic e-portfolio development, which was developed from the first pilot, was applied by the author and a modified orthodontic e-portfolio was evaluated with a longer period in the third part of this research.

Doubts still exist regarding the acceptability of the use of some instruments to assess reflective abilities and regarding the process of assessment of reflection in itself (Burnett et al. 2008; Hatton and Smith 1995; Kember et al. 1999; Richardson and Maltby 1995; Sumsion and Fleet 1996; Wong et al. 1995).

The aim of this second pilot was to highlight students' and mentors' perceptions on the use of the orthodontic e-portfolio in Cardiff as an assessment tool for reflection, personal and professional development learning outcomes and other learning outcomes.

From the analysis of the data collected with the interviews and the focus groups, it emerged that reflection is a skill to learn that depends partly on personality, culture and gender. People from more developed countries were more open to reflection and females could achieve higher levels of reflection more easily than males in the study. In general, the evaluation of the students' and mentors' feedback to the experience with the orthodontic e-portfolio indicates that it can stimulate and improve students' reflective skills. The orthodontic e-portfolio structure based on the learning outcomes of the programme, the reflective log with the questions and reflective samples, and students' discussion with closer persons (mentor and peers) in a relaxing environment are considered important factors to stimulate reflection. The presence of students' reflection is proved by:

- students' clear definition of reflection;
- students' acceptance of the reflective process;

- the increased students' self-awareness, confidence and motivation in the orthodontic programme and in the reflective process;
- the improved students' communication and interpersonal skills;
- the earlier students' problem solving and action planning skills;
- the students' feedback on programme organisation.

Students' reflective writing samples were evaluated by mentors three times during the experience with the portfolio showing an improvement of students' reflective abilities over time. Students' and mentors' opinions confirm the improvement of students' reflective skills during the experience and the reported signs that demonstrate the improvement are:

- the improvement of students' reflection through the level;
- the increased number of reflective acts;
- the increased easiness of the reflection process.

The students' and mentors' reported reasons that led to the improvement of students' reflective skills during the experience are:

- the information on reflection received before and during the experience;
- the reflective writing and the discussion with the mentor and feedback obtained;
- the discussion with peers and the researcher;
- the time and practice with the reflective process;
- the summative assessment of reflective skills;
- the increased knowledge in orthodontics.

When considering the use of a portfolio as an assessment tool, the students expressed doubts in the value of the process and mentors were not confident with the assessment of reflection. This was seen especially at the beginning of the experience. However with training and more understanding of the assessment process it became easier and more widely accepted. This had already been hypothesized by the participants of the first pilot and demonstrated in a previous study (Davis et al. 2009).

Postgraduate students and mentors must clearly have in mind that the outcome of this assessment is the process of reflection and not the product of reflection. In this way students can be genuine in the reflective process, even if the assessment is summative, and mentors can assess students' reflective skills properly.

Students' and mentors' feedback on the experience highlights some important factors for the success of summative assessment of reflection:

- reflective writing should be the starting point for assessment of students' reflective skills but discussion with the mentor should be considered the best way to allow reflection evaluation. This favours credibility (triangulation and member checks);
- the assessment dynamics should allow repeatability of the measurement of reflection favouring credibility (prolonged involvement);
- criteria to assess reflection should be simple and well defined; they should be well explained to students and mentors. Criteria favour dependability;
- practice and a process of calibration should be involved in order to improve the correct use of criteria and the dependability of the assessment;
- mentors suggested that more than one rater should be involved in marking reflection to increase dependability. However one rater who knows a student well and an adequate calibration exercise would increase the credibility (student-mentor relationship, member checks) and the dependability of the assessment respectively;
- the double role of mentor and assessor should be used to increase the credibility of the assessment (student-mentor relationship, member checks);
- the mark awarded and any feedback should be given to the students immediately post-assessment to maximise beneficial effects (member checks).

The three mentors' evaluation of the students' reflective writing samples over a year showed that there is an improvement of the assessors' skills in assessment of reflection. This supports the view that the usual 2-3 hours of assessors' training on the marking scheme for reflection used in previous studies (Burnett et al. 2008; Kember et al. 1999; Wong et al. 1995) are insufficient. It is suggested that assessors

undergo an appropriate calibration process before assessing students' reflective abilities.

Finally students and mentors affirmed that the self-reflection and the "PDP meeting" lead to a students' higher understanding of the learning outcomes of the programme and to analyse which outcomes have already been achieved and which not. They added that the assessment of reflective skills can be used to show indirectly the achievement of some learning outcomes such as: communication, decision making, clinical reasoning and judgment, professional and personal development.

The results of the second pilot study show an increased students' and mentors' support for the introduction of the orthodontic e-portfolio in the programme. This support was noted in particular at the end of the experience when they suggested that:

- the orthodontic e-portfolio is an effective tool to stimulate reflection;
- reflective abilities change over time and they can and must be assessed;
- the orthodontic e-portfolio can be effective for summative assessment of reflection and professionalism and formative assessment of the learning outcomes.

The students' and mentors' positive perceptions are in part related to the author's effort in sustaining the project, modifying the e-portfolio structure and educating and motivating students and mentors on the concept of reflection and its assessment.

The assessment of reflection in the experience was formative but with the scope of using it in a summative way in the future. In the present study, the influence of the author, which is an important characteristic of a qualitative approach, enabled the identification of the required conditions needed for the transfer from a formative to a summative value of the assessment of reflection by a portfolio. A summative use of the reflective e-portfolio is possible if the institution continues the work started by the author. For this to succeed the institution should recognize the importance of reflection and its assessment in the revised curriculum. Measures to introduce, to expand and to promote reflection and its assessment will be needed in order to

achieve the complex aim of the implementation of the reflective e-portfolio as a new method of assessment.

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Chapter 8 Appendices

8.1 Appendix I. Members of the Delphi panel

Angharad Brown, Fixed Term Training Appointment (FTTA)
Peter Durning, Consultant in Orthodontics
Chung How Kau, Lecturer in Orthodontics
Jeremy Knox, Reader in Orthodontics
Peter Nicholson, Consultant in Orthodontics
Stephen Richmond, Professor and Head of the Orthodontic Department
Simon Wigglesworth, Consultant in Orthodontics
Pamela Stephenson, Consultant in Orthodontics
Helen Taylor, Consultant in Orthodontics

8.2 Appendix II. The Round 1 questionnaire

Competences and assessment for the specialist orthodontist

Date:

Name:

E-mail:

ROUND ONE QUESTIONNAIRE

Section 1-Essential elements and main outcomes

- Record your agreement with each main outcome in the Table 8.1 as being a necessary achieved component of a postgraduate orthodontic programme in Cardiff.
- Use the 4-point scale:
 - 1: strongly agree
 - 2: agree
 - 3: disagree
 - 4: strongly disagree
- Add new items in the section OTHERS if you think it is necessary.

	Score
WHAT THE ORTHODONTIST IS ABLE TO DO	
Clinical information gathering	
Diagnosis and orthodontic treatment planning	
Treatment procedures	
Orthodontic treatment evaluation	
OTHERS	
HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE	
Patient management	
Communication	
Health promotion	
Health and safety	
Information handling	
Ethical behaviour	
Legislation	
Decision making, clinical reasoning and judgement	
Management of research	
Application of basic sciences	
OTHERS	
THE ORTHODONTIST AS A PROFESSIONAL	
Professional development	
Personal development	
OTHERS	

Table 8.1: The essential elements and main outcomes

Section 2-Learning outcomes and progress

Following the example in Table 8.2:

- Suggest in Table 8.3 the sequence of levels that should be attained for each learning outcome during a three year postgraduate programme in orthodontics in Cardiff.
- Use the following Novice-Expert scale (for further explanation see pages 9-10 of the explanatory notes):
N: Novice
B: Beginner
C: Competent
P: Proficient
E: Expert
- Add new outcomes and sequences in the section OTHER OUTCOMES if you think it is necessary.
- If you think that the wording of an outcome could be improved either write over the existing outcome, or write in the OTHER OUTCOMES box indicating the outcome to be altered.
- If you think an outcome is inappropriate put an asterisk in the “Do not agree” box.

	Years			Do not agree
	I	II	III	
WHAT THE ORTHODONTIST IS ABLE TO DO				
Clinical information gathering				
<i>Interview of patient, relatives and others (child or adult)</i>	C	P		
<i>Extra-oral examination</i>				*
<i>Intra-oral examination</i>	B	C	P	
<i>Functional examination</i>	N	B	C	
<i>Photographs</i>		N	B	
<i>Radiographs</i>	C	P		
<i>Cephalometric tracing</i>				*
<i>Impression taking</i>	B	C	P	
<i>Jaw registration using facebow recordings</i>	B	C		
<i>Occlusal registration with wax bite</i>		N	B	
<i>Cast analysis</i>				*
<i>Mounting casts on an articulator</i>	B		C	
OTHERS OUTCOMES				

Table 8.2: An example of how complete Table 8.3

	Years			Do not agree
	I	II	III	
WHAT THE ORTHODONTIST IS ABLE TO DO				
Clinical information gathering				
<i>Interview of patient, relatives and others (child or adult)</i>				
<i>Extra-oral examination</i>				
<i>Intra-oral examination</i>				
<i>Functional examination</i>				
<i>Photographs</i>				
<i>Radiographs</i>				
<i>Cephalometric tracing</i>				
<i>Impression taking</i>				
<i>Jaw registration using facebow recordings</i>				
<i>Occlusal registration with wax bite</i>				
<i>Cast analysis</i>				
<i>Mounting casts on an articulator</i>				
OTHER OUTCOMES				
Diagnosis and orthodontic treatment planning				
<i>Guiding the developing occlusion</i>				
<i>Adult patient</i>				
<i>Cranio-mandibular dysfunction patient</i>				
<i>Restorative and periodontal patient</i>				
<i>Orthognathic patient</i>				
<i>Malocclusion and medical problem</i>				
<i>Diagnose and classify common craniofacial anomalies</i>				
<i>Treatment planning of common craniofacial anomalies</i>				
OTHER OUTCOMES				
Treatment procedures				
<i>Space maintainers</i>				
<i>Removable appliance</i>				
<i>Functional appliance</i>				
<i>Extraoral appliance</i>				
<i>Fixed appliance</i>				
<i>Retention appliances (removable and fixed)</i>				
<i>Occlusal splints</i>				
OTHER OUTCOMES				

Orthodontic treatment evaluation					
<i>Orthodontic treatment results</i>					
<i>Iatrogenic effects of orthodontic treatment</i>					
<i>Long term effect of orthodontic treatment</i>					
OTHER OUTCOMES					
HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE					
Patient management					
<i>Patient referral</i>					
<i>Manage appropriately all forms of orthodontic emergency</i>					
<i>Patient-centred</i>					
OTHER OUTCOMES					
Communication					
<i>Appropriate communication skills with a range of patients and relatives</i>					
<i>Appropriate communication skills with other professional colleagues</i>					
<i>Appropriate communication skills with personnel</i>					
<i>Appropriate communication skills with technician</i>					
OTHER OUTCOMES					
Health promotion					
<i>Oral health</i>					
<i>Health education</i>					
OTHER OUTCOMES					
Health and safety					
<i>Prevention of cross-infection in orthodontic</i>					
OTHER OUTCOMES					
Information handling					
<i>Clinical records</i>					

<i>Computer based technology</i>					
OTHER OUTCOMES					
Ethical behaviour					
<i>Main ethical principles</i>					
<i>Dental ethics</i>					
OTHER OUTCOMES					
Legislation					
<i>Professional legislation</i>					
<i>National legislation</i>					
OTHER OUTCOMES					
Decision making, clinical reasoning and judgement					
<i>Clinical reasoning</i>					
<i>Creativity/resourcefulness</i>					
<i>Decision making</i>					
OTHER OUTCOMES					
Management of research					
<i>Statistics application</i>					
<i>Research and scientific methodologies</i>					
OTHER OUTCOMES					
Application basic science					
<i>Cell and molecular biology in orthodontics</i>					
<i>Genetics in orthodontics</i>					
<i>Craniofacial embryology</i>					
<i>Somatic and craniofacial growth</i>					
<i>Physiology and pathophysiology of the stomatognathic system in orthodontics</i>					
<i>Psychology in orthodontics</i>					
<i>Tooth movement and facial orthopaedics</i>					
<i>Biomechanics</i>					
<i>Radiology in orthodontics</i>					
<i>Orthodontic materials</i>					
<i>Aetiology of malocclusion</i>					
<i>Education</i>					

<i>Epidemiology in orthodontics</i>					
OTHER OUTCOMES					
THE ORTHODONTIST AS A PROFESSIONAL					
Professional development					
<i>Critical thinking</i>					
<i>Evidence based medicine</i>					
<i>Undertake an audit</i>					
<i>Team approach</i>					
<i>Keep up to date</i>					
<i>Surgery management</i>					
<i>Personnel management</i>					
<i>Finance</i>					
OTHER OUTCOMES					
Personal development					
<i>Self-awareness</i>					
<i>Self-learner</i>					
<i>Personal growth</i>					
<i>Self care</i>					
<i>Career development</i>					
OTHER OUTCOMES					

Table 8.3: The learning outcomes and progress

Section 3-Assessment methods for each stage of the Competency Continuum

Using the glossary of the assessment methods on page 24 of the explanatory section:

- Rate your agreement that the assessment methods listed in Table 8.4 are an appropriate way to assess students at each stage of the Competency Continuum (Novice, Beginner, Competent, Proficient and Expert).
- Use this 4-point scale:
 - 1: strongly agree
 - 2: agree
 - 3: disagree
 - 4: strongly disagree
- Add new items in the section OTHERS if you think it is necessary.

	Score
Novice	
Multiple Choice Questions-True/False type	
Multiple Choice Questions-Extended Matching	
Short Answer Questions	
Lab practical	
Interactive examination (Self and Peer assessment ability)	
Examining Board	
OTHERS	
Beginner	
Multiple Choice Questions -Extended Matching	
Short Answer Questions	
Modified Essay Questions (MEQ)	
Structured viva	
Unstructured viva	
Interactive examination (Self and Peer assessment ability)	
Poster presentation	
Lab practical	
Record review	
Simulation	
Logbook	
Examining Board	
OTHERS	
Competent	
Essay	
Unstructured viva	
Structured viva	
Triple jump examination	
Structured trainer's report	
Peer review	
Case presentation	
Logbook	
Portfolio	
Objective Structured Clinical Examination (OSCE)	
Video assessment	
Structured Clinical Operative Test (SCOT)	
Extended Structured Clinical Operative Test (ESCORT)	
Audit	
Examining Board	
OTHERS	

Proficient	
Dissertation, project	
Patient management problems	
Case presentation	
Peer review	
Logbook	
Portfolio	
Structured Clinical Operative Test (SCOT)	
Extended Structured Clinical Operative Test (ESCORT)	
Audit	
Examining Board	
OTHERS	
Expert	
Self and peer assessment	
Publications, conference papers	
case presentations	
OTHERS	

Table 8.4: The summative and formative assessment methods appropriate at various stages of the Competency Continuum

8.3 Appendix III. The Round 1 invitation letter

14 June 2004

Dear xxxxxx,

I am a research postgraduate student in the Dental Hospital in Cardiff. I am conducting a research project entitled "Competences and assessment for the specialist orthodontist".

I am developing a list of outcomes and assessment methods that could be useful for curriculum development in the orthodontic training programme in Cardiff.

The aim of this study is to collect your opinions on the outcomes and assessment methods to achieve agreement on them.

I would be extremely grateful if you could help me with my data collection by participating in my research. I enclosed an explanatory section that should provide you with sufficient information about the nature and the purpose of the research, how it will be conducted and your role in it.

If you decide to participate you should complete the questionnaire enclosed and return it to me by Monday 16 August in the accompanying envelope.

Many thanks

Yours sincerely

Miss Ingrid Tonni
Dental Health and Biological Sciences
Orthodontic Department
Dental School
Cardiff
CF14 4XY

Enclosed: "Explanatory section"
"Questionnaire"

8.4 Appendix IV. The Round 1 reminder letter

13 September 2004

Dear xxxxx,

As a follow up to my letter dated 14 June 2004, I would like to thank all those who very kindly completed my MPhil Questionnaires related to “Competences and assessment for the specialist orthodontist”.

If anyone still has questionnaires they would like to return I would be grateful to receive these by 18 October 2004. I can be contacted at the following email address ingrid.tonni@libero.it if a duplicate set is required.

May I thank you all again for your time.

Yours sincerely

Ingrid Tonni
Dental Health and Biological Sciences
Orthodontic Department
Dental School
Cardiff
CF14 4XY

8.5 Appendix V. The Round 2 questionnaire

Competences and Assessment for the Specialist Orthodontist

Date:
Name:
E-mail:

ROUND TWO QUESTIONNAIRE

Section 1-Essential elements and main outcomes

The round one questionnaire results showed consensus on each main outcome listed in Table 8.5. These main outcomes represent the abilities that need to be achieved at the end of an orthodontic postgraduate programme.

WHAT THE ORTHODONTIST IS ABLE TO DO
Clinical information gathering
Diagnosis and orthodontic treatment planning
Treatment procedures
Orthodontic treatment evaluation
HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE
Patient management
Communication
Health promotion
Health and safety
Information handling
Ethical behaviour
Legislation
Decision making, clinical reasoning and judgement
Management of research
Application of basic sciences
THE ORTHODONTIST AS A PROFESSIONAL
Professional development
Personal development

Table 8.5: The essential elements and main outcomes

Section 2-The learning outcomes and progress

In the round one questionnaire you have considered the learning outcomes and suggested the sequence of levels that should be attained by the end of each year for each learning outcome during a three year postgraduate programme in orthodontics.

The round one questionnaire results showed:

- Consensus about the majority of learning outcomes considered.
- Disagreement about 24 learning outcomes.
- Agreement to exclude two learning outcomes from the list.

For simplicity only the learning outcomes excluded from the list and those on which agreement was not achieved are considered in the round two questionnaire.

- Reconsider your scores regarding the learning outcomes level students should achieved at the end of each year of the programme and, taking into account how the majority scored (modes) in the round one questionnaire, re-rate each learning outcome in the column “new scores” (Table 8.6).
- Use the Novice-Expert scale (for further explanation see pages 8-10 of the explanatory section).
- Please also provide a short comment justifying your choice.

	YEARS			YEARS			YEARS		
	I	II	III	I	II	III	I	II	III
	Your scores			Modes			New scores		
WHAT THE ORTHODONTIST IS ABLE TO DO									
Clinical information gathering									
<i>Functional examination</i>				C	P				
<i>Jaw registration using facebow recordings</i>				B	C				
<i>Mounting casts on an articulator</i>				B	C	P			
Diagnosis and orthodontic treatment planning									
<i>Craniomandibular dysfunction patient</i>					B/C				
<i>Malocclusion and medical problem</i>					B	C/P			
<i>Treatment planning of common craniofacial anomalies</i>						N/B			
Treatment procedures									
<i>Retention appliances (removable and fixed)</i>				B/C					
<i>Occlusal splints</i>					B/C				
Orthodontic treatment evaluation									
<i>Long term effect of orthodontic treatment</i>				N	B/C				
HOW THE ORTHODONTIST APPROACHES HIS/HER PRACTICE									
Patient management									
<i>Patient referral</i>				N	B/C				
Health and safety									
<i>Prevention of cross-infection in orthodontics</i>				B/C					
Information handling									
<i>Clinical records</i>				B/C					
Ethical behaviour									
<i>Main ethical principles</i>				B/C					
Legislation									
<i>National legislation</i>						B/C			
Decision making, clinical reasoning and judgement									
<i>Decision making</i>					*				
Management of research									
<i>Statistics application</i>				N/B		B/C			
<i>Research and scientific methodologies</i>					B	C			
Application basic science									
<i>Genetics in orthodontics</i>					B/C	P			
<i>Psychology in orthodontics</i>					*				
<i>Education</i>						N/B/P			
<i>Epidemiology in orthodontics</i>				B/C	C				
THE ORTHODONTIST AS A PROFESSIONAL									
Professional development									
<i>Evidence based medicine</i>				N/B	B				
<i>Keep up to date</i>						B			
<i>Finance</i>						N			
Personal development									
<i>Self care</i>					N/B	B			
<i>Career development</i>						B			

Table 8.6: The learning outcomes and progress

Comments:

Functional examination

.....
.....

Jaw registration using facebow recordings

.....
.....

Mounting casts on an articulator

.....
.....

Cranio-mandibular dysfunction patients

.....
.....

Malocclusion and medical problem

.....
.....

Treatment planning of common Craniofacial Anomalies

.....
.....

Retention appliances (removable and fixed)

.....
.....

Occlusal splints

.....
.....

Long term effects of the orthodontic treatment

.....
.....

Patient referral

.....
.....

Prevention of cross-infection in orthodontics

.....
.....

Clinical records

.....
.....

Main ethical principles

.....
.....

National legislation

.....
.....

Decision making

.....
.....

Statistics application

.....

.....

Research and scientific methodologies

.....

.....

Genetics in orthodontics

.....

.....

Psychology in orthodontics

.....

.....

Education

.....

.....

Epidemiology in orthodontics

.....

.....

Evidence based medicine

.....

.....

Keep up to date

.....

.....

Finance

.....

.....

Self care

.....

.....

Career development

.....

.....

Section 3-Assessment methods for each stage of the Competency Continuum

In the first round questionnaire you have expressed your dis/agreement about each of the assessment methods listed below as an appropriate way to assess students at each of Novice, Beginner, Competent, Proficient and Expert stages.

The round two questionnaire' results showed:

- Agreement about the majority of the assessment methods associated with each stage of the Competency Continuum.
- Disagreement about 4 assessment methods (in blue in table 8.7).
- Exclusion of 1 assessment method (in blue in table 8.7).

Novice	Proficient
Multiple Choice Questions-True/False type	Dissertation, Project
Multiple Choice Questions-Extended Matching	Patient management problems
Short Answer Questions	Case presentation
Lab Practical	Peer Review
Interactive examination	Logbook
1 Examining Board	Portfolio
Beginner	Structured Clinical Operative Test (SCOT)
Multiple Choice Questions –Extended Matching	Extended Structured Clinical Operative Test (ESCORT)
Short Answer Questions	Audit
Modified Essay Questions (MEQ)	Examining Board
Structured Viva	Expert
2 Unstructured viva	Self and Peer-assessment (Teaching, Clinical work)
Interactive Examination	Publications, Conference papers, Books
3 Poster presentation	Conference Presentations
Lab Practical	
Record review	
Simulation	
Logbook	
4 Examining Board	
Competent	
Essay	
Unstructured viva	
Structured viva	
5 Triple jump examination	
Structured trainer's report	
Peer Review	
Case Presentation	
Logbook	
Portfolio	
Objective Structured Clinical Examination (OSCE)	
Video Assessment	
Structured Clinical Operative Test (SCOT)	
Extended Structured Clinical Operative Test (ESCORT)	
Audit	
Examining Board	

Table 8.7: Results from round 1 questionnaire

For simplicity only the assessment methods excluded from the list and those which agreement was not achieved on are considered in the round two questionnaire.

Using the glossary of the assessment methods on page 24 of the explanatory section:

- Reconsider your score and, taking into account how the majority scored (mode) in the round one questionnaire, re-rate each item in the column “new score” (Table 8.8).
- You have used this 4-point scale:
1: strongly agree
2: agree
3: disagree
4: strongly disagree
- Provide a short comment to justify your choice.

	your score		mode		new score
1 Examining Board			3		
2 Unstructured viva			1		
3 Poster presentation			3		
4 Examining Board			3		
5 Triple jump examination			2		

Table 8.8: The assessment methods appropriate at various stage of the Competency Continuum

Comments:

1 Examining Board

.....

2 Unstructured viva

.....

3 Poster presentation

.....

4 Examining Board

.....

5 Triple jump examination

.....

8.6 Appendix VI. The Round 2 covering letter

21 January 2005

Dear xxxxx,

As a follow up to my letter dated 13 September 2004, I would like to thank you for having very kindly completed round one questionnaire related to “Competences and Assessment for the Specialist Orthodontist”.

I have analysed the questionnaires and I have identified patterns of agreement using a qualitative and a quantitative (frequency distributions) analysis.

I have prepared a round two questionnaire based on feedback of the areas of disagreement.

The percentage of agreement found is 77.8% so the second round questionnaire is much shorter than the first one and it can be completed easily in 10 minutes.

I would be grateful if you could complete the tasks requested within the round two questionnaire and return it to me (using the enclosed envelope) by 21 February 2005.

I can be contacted at the following email address ingrid.tonni@libero.it .

May I thank you all again for your time.

Yours sincerely,

Ingrid Tonni
Dental Health and Biological Sciences
Orthodontic Department
Dental School
Cardiff
CF14 4XY

8.7 Appendix VII. The Round 2 reminder letter

21 February 2005

Dear xxxxx,

As a follow up to my letter dated 21 January 2005, I would like to thank all those who very kindly completed the round two questionnaire related to “Competences and Assessment for the Specialist Orthodontist”.

If anyone still has questionnaires they would like to return I would be grateful to receive these as soon as possible. I can be contacted at the following email address ingrid.tonni@libero.it if a duplicate set is required.

May I thank you all again for your time.

Yours sincerely

Ingrid Tonni
Dental Health and Biological Sciences
Orthodontic Department
Dental School
Cardiff
CF14 4XY

8.8 *Appendix VIII. The first pilot invitation letter for students and supervisors*

17 July 2006

Dear xxxxxx,

I am a postgraduate student currently training in the orthodontic department, Dental Hospital Cardiff.

As part of my training I am conducting a research project entitled "Evaluation of a reflective e-portfolio for postgraduate orthodontic students".

I would be extremely grateful if you could help me with my data collection participating to my research.

I enclosed a "Participant information sheet" and a "Consent form". You should read carefully the information in the first document. After you decide to take part you will be asked to sign the "Consent form" and then to compile the questionnaire.

Thank you very much for your time.

Yours sincerely

Miss Ingrid Tonni
Postgraduate student in Orthodontics

Enclosed: "Participant information sheet"
"Consent form"

8.9 Appendix IX. The first pilot information sheet for students and supervisors

PARTICIPANT INFORMATION SHEET

1. Study title

Evaluation of a reflective e-portfolio for postgraduate orthodontic students.

2. Invitation paragraph

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

3. What is the purpose of the study?

The programme organisers of the MScD programme in orthodontics in Cardiff made the decision to introduce an e-portfolio in the training of the postgraduate students of 2006/07. This fulfils the requirements of the University for degree courses to include a Personal Development Planning (PDP), and can also be used to satisfy the requirements of the accrediting body for the professional aspects of the programme. A systematic synthesis of research relating to the process of learning that underlines PDP, conducted by Gough et al. (2003) shows that PDP supports learning but concerns remain regarding the issues of using PDP as an assessment tool.

The aim of this study is to collect students' and supervisors' opinions on the structure and content of the e-portfolio to allow for improvement in the future.

4. Why have I been chosen?

It is of fundamental importance to obtain opinions on the use of an e-portfolio content and structure both from students and staff leading the MScD orthodontic programme in Cardiff.

The postgraduate intake of 2006/2007 and three members of the academic staff will be asked to take part to the study.

5. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

6. What will happen to me if I take part?

The developed e-portfolio will be piloted for two months in the orthodontic department in Cardiff and after that you will be asked to complete a questionnaire about the experience. Half of an hour will be needed to complete the questionnaire.

7. What about confidentiality?

Participants' confidentiality will be maintained. Data will be collected, stored, analysed and results will be used in ways that will not lead to accidental disclosure of participants' identity.

8. What do I have to do?

Students should fill out the e-portfolio for two months and meet with their own supervisor monthly. Students should give part of the content of their portfolios to supervisors before the meeting so that supervisors could be ready for discussion.

Students and supervisors will complete a questionnaire about the experience that will take about half of an hour.

9. Are there any risks?

Mechanisms will be introduced to avoid distress:

- the researcher will be a postgraduate student;
- the researcher will respect individual, cultural and role differences including ethnicity, gender, language, race, religion and socio-economic status of the participants;
- the researcher will keep appropriate and genuine records of questionnaire data;
- students' participation will have no impact on the grades awarded during the year or relationships with the institution.

A third person (XXXXXXXX) will be available for discussion if psychological problems will arise (anxiety, emotional upset).

Participants will have the possibility to look at their own completed questionnaire and amending as necessary.

10. What will happen to the results of the research study?

The data from this research study will be analysed and the results will be used in the chapters results and discussion of the project dissertation. You will be able to find a copy of the thesis in the library of the dental school in Cardiff after September 2010. The results of the project could also be published. No identifying information about the research participants will appear in the thesis or in publications.

11. Who is organising and funding the research?

The project is self-funded.

12. Contact for Further Information

Contact point for further information: ingrid.tonni@libero.it

8.10 Appendix X. The first pilot consent form for students and supervisors

CONSENT FORM

Title of Project:

Evaluation of a reflective e-portfolio for postgraduate orthodontic students.

Name of Researcher: Ingrid Tonni

Please initial box

1. I confirm that I have read and understand the information sheet dated XXXXXXXXX
(version XX) for the above study and have had the opportunity to ask questions.

☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time,
without giving any reason.

☐

3. I agree to take part in the above study.

☐

Name of Participant

Date

Signature

Name of Person taking consent
(if different from researcher)

Date

Signature

Researcher

Date

Signature

8.11 Appendix XI. The second pilot interview topics list

In the interview topics list there were statements (A, B, C, D), which represented the study objectives, and related questions.

A) Extent to which students demonstrate a reflective approach using an e-portfolio

- How have students demonstrated a reflective approach using the orthodontic e-portfolio?

B) Effectiveness of orthodontic e-portfolio as an instrument for summative assessment of reflection

- How did you find the assessment categories, criteria and procedure?
- How was assessing reflection?

C) Effectiveness of orthodontic e-portfolio as an instrument for formative assessment of reflection

- Did you find an improvement in reflection level of students during this year? How and what do you think is the reason?
- What do you think of the mentor's combined role of supervisor and assessor?

D) Effectiveness of orthodontic e-portfolio as an instrument for formative and summative assessment of learning outcomes

- Did reflection and discussion with you help students towards the achievement of the learning outcomes of the programme? How?
- Having in mind the list of the 16 learning outcomes, do you think that some of them could be assessed easily using the orthodontic e-portfolio approach?

8.12 Appendix XII. The second pilot focus group topics list

In the focus group topics list there were statements (A, B, C, D), which represented the study objectives, and related questions.

A) Extent to which students demonstrate a reflective approach using an e-portfolio

- How has using the orthodontic e-portfolio helped you to reflect?
- What did you get from the reflection process?

B) Effectiveness of orthodontic e-portfolio as an instrument for summative assessment of reflection

- How did you feel about showing your reflection and deep reflection (emotions, feelings) for assessment?
- How did you find the assessment procedure and its results?

C) Effectiveness of orthodontic e-portfolio as an instrument for formative assessment of reflection

- Did you find an improvement of your reflection level during this year? Why do you say this?
- What did help you to develop and improve your reflective abilities?

D) Effectiveness of orthodontic e-portfolio as an instrument for formative and summative assessment of learning outcomes

- Did reflection and discussion with mentors help you towards the achievement of the learning outcomes of the programme? How?
- Having in mind the list of the 16 learning outcomes, do you think that some of them could be assessed using the orthodontic e-portfolio approach?

8.13 Appendix XIII. Task for mentors after each “PDP meeting”

Task

You should read and grade the following examples of students’ reflection taken from the student’s e-portfolio. You should use the marking scheme (level 1, 2 and 3) and the assessment criteria you apply to mark students’ reflective ability in the “PDP meeting”. The data collected from this task will be helpful to evaluate reliability of the assessment method of reflection.

Level Clinical information gathering

OSCE exam and working in clinic helped me in beginning to pick up the skill in terms of speed & efficiency to take history and examination. However, I feel I do not have a proper systemized approach to decide on the problem lists in order to formulate a TP. Discuss with supervisor the reasons behind certain TP which need more explanations. If time is short during clinical sessions, I should ask them when I get the opportunity.

Level Clinical information gathering

On my first day in the clinic I’ve started taking patient’s history and doing the clinical examinations. I was so nervous and I spent very long time, I tried to collect information as much as I could.

Level ... Application basic science

I had trouble understanding orthodontic tooth movement. However after doing a presentation on theories of tooth eruption plus reading the related journals I found that both topics are related and I’m able to understand the topic better. It made me to realize how important knowledge of the basic science is and when you understand it, it makes you want to read and learn more.

Level ... Decision making clinical reasoning and judgment

I found myself getting better in making the decisions in the clinic. Before I used to call the supervisor for every patient but now sometimes I can decide what does the pt. need like repositioning of the bracket or upgrade the archwires.

Level... Patient management

I noticed that some of the undergraduate students could be using patient records in communal areas inappropriately. This became apparent when I was sent a copy of a page of documents belonging to a patient under my care, which was left in the library photocopier.

Level ... Patient management

Although it is quite common to see patients who have poor oral hygiene status during each visit, I try to reinforce oral hygiene to them when I find that the oral hygiene state is not satisfactory. I find that using the mirror to show to the patients the areas that they miss quite effective. Most come back with better oral hygiene at the following visits although some do not seem to improve. Surprisingly, it seemed that one or two moms are taking the defensive mode when I commented on their child’s poor oral hygiene. However, with further show and tell technique, I was able to manage the situation. I realized that during the following visits, I find it difficult to tell the same patients that their oral hygiene, even if it had improved a little, in some case was still not satisfactory-not because I was afraid of the patient but the reason behind it was that I did not wish to offend the mothers. Having realized this, I know I

should be more firm in the future because it is for the patient's benefit and overall oral health.

Level ... Patient management

My patient management skills are improving. I now tell my patients that their oral hygiene is appalling. I think in those patients that it has got to such a state that it is proving detrimental to their dental health, I will not start fixed appliance treatment, and I make this very clear to them.

Level ... Patient management

Reinforcing oral hygiene is an important part of orthodontic treatment. I reinforce oral hygiene to patients at every opportunity. I used to find it difficult to inform patients their oral hygiene was ineffective or inadequate. As I treat more patients I see how damaging poor oral hygiene is for orthodontic patients and I am more confident in tackling the oral hygiene issue. I am also better at to issuing warnings with regards to the stopping of orthodontic treatment if the oral hygiene is poor.

8.14 Appendix XIV. The second pilot invitation letter for students and mentors

28 September 2007

Dear xxxxxx,

I am a postgraduate student currently training in the orthodontic department, Dental Hospital Cardiff.

As part of my training I am conducting a research project entitled “Evaluation of a reflective e-portfolio for postgraduate orthodontic students”.

I would be extremely grateful if you could help me with my data collection by participating in my research.

I enclosed a “Participant information sheet” and a “Consent form”. You should read carefully the information in the first document. These will be explained again to you at the time of the interview or focus group and you will have another chance to ask questions. After you decide to take part you will be asked to sign the “Consent form” before the interview or focus group.

Thank you very much for your time.

Yours sincerely

Miss Ingrid Tonni
Postgraduate student in Orthodontics

Enclosed: “Participant information sheet”
“Consent form”

8.15 Appendix XV. The second pilot information sheet for students and mentors

PARTICIPANT INFORMATION SHEET

1. Study title

Evaluation of a reflective e-portfolio for postgraduate orthodontic students.

2. Invitation paragraph

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

3. What is the purpose of the study?

The programme organisers of the MScD programme in orthodontics in Cardiff made the decision to introduce an e-portfolio in the orthodontic department. This fulfils the requirements of the University for degree courses to include a Personal Development Planning (PDP), and can also be used to satisfy the requirements of the accrediting body for the professional aspects of the programme. A systematic synthesis of research relating to the process of learning that underlines PDP, conducted by Gough et al. (2003) shows that PDP supports learning but concerns remain regarding the issues of using PDP as an assessment tool.

The developed e-portfolio has been already piloted for 2 months in the orthodontic department in Cardiff and students' and supervisors' opinions have been collected on its structure and content. The e-portfolio has been modified on the basis of the results of the first pilot.

In this study the modified e-portfolio will be piloted for 1 year in the orthodontic department with the new student intake of 2007/2008. The purpose is to evaluate the effectiveness of the modified e-portfolio as a learning and assessment tool.

4. Why have I been chosen?

It is of fundamental importance to obtain opinions on the use of an e-portfolio as a learning and assessment tool both from students and staff leading the MScD orthodontic programme in Cardiff.

The postgraduate intake of 2007/2008 and 3 members of the academic staff will be asked to take part to the study.

5. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

6. What will happen to me if I take part?

The modified e-portfolio will be piloted for 1 year in the orthodontic department in Cardiff and after that you will be asked to take part in a focus group (for students) or interview (for mentors) that will last approximately one hour.

Further students should give permission to the researcher to take some reflective writing sections present in their portfolio. Mentors will be asked to score those sections of students' reflective writing

using the coding scheme for reflection present in the orthodontic e-portfolio. This will take about 30 minutes of the mentor's time.

7. What about confidentiality?

Participants' confidentiality will be maintained. Data will be collected, stored, analysed and results will be used in ways that will not lead to accidental disclosure of participants' identity.

8. What do I have to do?

If you are a student you will take part in a focus group where the topic of discussion will be the experience of using the modified e-portfolio as a learning and assessment tool during your first year of orthodontic training. You should also give permission to use some of the reflective writings present in your portfolio.

If you are a member of the academic staff (mentor) you will be interviewed on the effectiveness of using the modified e-portfolio as a learning and assessment tool. You will also be asked to score some sections of students' reflective writing taken from the orthodontic e-portfolio so that inter-mentors reliability will be evaluated.

Focus groups and interviews will last approximately 1 hour.

9. Are there any risks?

Mechanisms will be introduced to avoid distress and create a level of comfort during interviews and focus groups and to respect participants.

- the researcher will be a postgraduate student;
- the researcher will respect individual, cultural and role differences including ethnicity, gender, language, race, religion and socio-economic status of the participants;
- focus groups and interviews will be conducted in an informal way involving gathering and giving of information by students and mentors;
- the researcher will use open questions and will not lead participants to say or agree things they could regret afterward;
- the researcher will keep appropriate and genuine records of data collected with the interviews and focus groups;
- students' participation will have no impact on the grades awarded during the year or relationships with the institution.

A third person (XXXXXXXX) will be available for discussion if psychological problems arise (anxiety, emotional upset).

Participants will have the possibility of reading the transcript of their own interview or focus group and amending as necessary.

10. What will happen to the results of the research study?

The data from this research study will be analysed and the results will be used in the chapter results and discussion of the project dissertation. You will be able to find a copy of the thesis in the library of the dental school in Cardiff after September 2010. The results of the project could also be published. No identifying information about the research participants will appear in the thesis or in publications.

11. Who is organising and funding the research?

The project is self-funded.

12. Contact for Further Information

Contact point for further information: ingrid.tonni@libero.it

8.16 Appendix XVI. The second pilot consent form for students and mentors

CONSENT FORM

Title of Project:

Evaluation of a reflective e-portfolio for postgraduate orthodontic students.

Name of Researcher: Ingrid Tonni

Please initial box

1. I confirm that I have read and understand the information sheet dated XXXXXXXX (version XX) for the above study and have had the opportunity to ask questions.

☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.

☐

3. I agree to take part in the above study.

☐

Name of Participant

Date

Signature

Name of Person taking consent
(if different from researcher)

Date

Signature

Researcher

Date

Signature