The Higher Education Academy

Interdisciplinary Teaching and Learning Group

Students' experiences of interdisciplinary Masters' courses

Lindsey McEwen, Ros Jennings, Rob Duck and Hazel Roberts

Students' experiences of interdisciplinary Masters' courses

Lindsey McEwen, Ros Jennings, Rob Duck and Hazel Roberts

ISBN: 978-1-905788-96-5
May 2009

Published by: The Interdisciplinary Teaching and Learning Group, Subject Centre for Languages, Linguistics and Area Studies, School of Humanities, University of Southampton, Southampton, SO17 1BJ.

Tel: 023 8059 4814
Fax: 023 8059 4815
E-mail: llas@soton.ac.uk
www.heacademy.ac.uk/ourwork/networks/itlg

Series Editor: John Canning

Table of contents

List of Figures

List of Tables

Students' experiences of interdisciplinary Masters' courses

1. Project background

Student experiences of undergraduate learning have received extensive research attention; see for example, the *Enhancing Teaching - Learning Environments in Undergraduate Courses* project (ELT; Entwistle, 2003). In contrast, the learning experiences of taught postgraduate students have been subject to much less investigation. This is despite significant changes to the character of UK taught postgraduate (PGT) provision over the last 10 years. The academic research-orientated 'extension' or 'subject continuous study' taught Masters' awards, primarily for home-grown students with the strongest undergraduate degrees, have long-term status (McEwen *et al.*, 2008). Many were mainly 'single discipline' based. More recently, many Higher Education Institutions (HEIs) in the UK have added vocationally-orientated and applied 'taught' Masters' courses to their postgraduate portfolios (Eastwood, 2005; McEwen, 2005). At the same time, many Masters' courses have become more interdisciplinary in response to the vocational needs of employers and the increasing interdisciplinarity of research activity itself. The nature of PGT student cohorts has also become much more diverse, with increasing numbers of international students, work-based learners with prior work experience, and students with less traditional prior learning experiences.

This project aims to evaluate the learning experiences of taught postgraduate students on interdisciplinary Masters' courses using a case-study approach. It draws on the conceptual framework used to evaluate undergraduate learning experiences (Entwistle, 2003) while capitalising on prior experience in the project team of evaluating postgraduate courses from different stakeholder perspectives (McEwen *et al.*, 2003; McEwen *et al.*, 2005) and in evaluating diversity including interdisciplinarity in postgraduate co-learning environments (Le Heron *et al.*, 2006; Jennings, 2003; Jennings and Hassam, 2004; McEwen *et al.*, 2008).

Key themes explored in the project include:

- The existing knowledge, understanding, abilities, motivations and conceptions/ styles of learning that PGT students have from their disciplinary homes and how this is brought to a postgraduate co-learning environment;
- How postgraduate students in interdisciplinary Masters' courses perceive the teaching-learning environment;
- How postgraduate students approach learning and studying in an interdisciplinary context; and
- How students perceive the learning outcomes achieved in interdisciplinary Masters' courses.

2. Structure of the report

The report has the following structure:

- Context setting: Master's level study;
- Literature review;
- Research design and methodology;
- Results and discussion;
- Conclusions and recommendations.

3. Context setting: Master's level study

Before any evaluation of students' interdisciplinary learning (IDL) experiences at Master's level, there are three important background contexts to consider:

- the diversity of the students' prior experiences brought to study at postgraduate level and how prior academic experience integrates with other aspects of student diversity;

- the nature of the Master's level 'bar' and how the setting and challenge for interdisciplinary learning differs from that which might be experienced at undergraduate level; and

- the diverse character of taught Master's provision.

3.1 Student diversity

The nature of recruitment on taught Masters' courses has become increasingly diverse, with the expansion of vocationally-orientated degree programmes that deliver on the requirements for work-based learning (WBL) in different forms, including continued professional development from workplace and the recruitment of students with prior vocational experiences. In addition, there has been both internationalisation of curricula and increasing recruitment of international students and students with less traditional prior learning experiences. The latter have been explicitly targeted in response to widening access and participation agendas in a more 'inclusive' higher education. Thus different prior discipline background of the student is only one of a potentially large number of prior learning experiences brought to the learning 'table' at Master's level (Table 1).

Table 1: Dimensions of diversity among the postgraduate student body (source: McEwen et al., 2008)

• Nature and extent of prior academic experience (including disciplinary background); • Personal characteristics (e.g. age, gender, race, culture, linguistic skills, disability); • Personal commitments (part-time/ full-time; with dependants); • Vocational experience (career stage, workplace and professional development aspirations).

All these variables have the potential to impact on what an individual student brings to interdisciplinary learning and how interdisciplinary learning is perceived. In addition, other prior academic experiences, including experience of different teaching methods and models, programme styles, institutional contexts and work experience, will also have an impact.

3.2 'Postgraduateness' and the Master's level 'bar'

There have been national/ international debates over what postgraduate (M-level) means in terms of knowledge and skills levels, with level descriptors (QAA, SEEC, NICATS, Bologna etc.) providing guidance. 'Postgraduateness' can be defined in terms of 'M-level' knowledge and skills and the distinctive approach to learning activities (see McEwen *et al*., 2008). Table 2 provides an indicative listing of SEEC level descriptors, demonstrating the strong emphasis on skill development. However, these level descriptors give little attention to affective/attitudinal domains and personal skill development that are also considered important (Fink, 2003) In particular, the concept of 'creative professionalism' (Kennedy, 2002) with enhanced personal skills is considered important. Postgraduate learning design also frequently has a distinctive approach to learning activities and the socialisation of postgraduates. For further discussion, see McEwen *et al*., (2008).

3.3 Different types of interdisciplinary Masters' courses

There are a number of different types of interdisciplinary Masters' course currently on offer in the UK. These vary on a number of criteria, including:

- The balance between theory and practice;
- The degree of vocationality and whether the area of 'business studies' is one of the integrated subjects; and
- The discipline mix that they recruit and integrate in terms of the student body and the course focus.

The interdisciplinary taught postgraduate courses can be divided into six main categories:

1. Postgraduate 'extension' courses with an explicitly academic/ research focus;
2. Research methods courses (e.g. as a taught element in preparation for research study, PGR);
3. Applied courses (with vocational elements and 'management' elements; WBL/WPL);
4. Interprofessional courses (e.g. in primary health care; e.g. Pullon and Fry, 2005; Salvatori *et al*., 2007);
5. Courses with a sustainable development (SD) core or focus (e.g. see Selby, 2006);
6. Specialist skills courses (e.g. Geographical Information Systems -GIS, remote sensing; Environmental Impact Assessment).

Table 2: Example learning descriptors (based on SEEC, 2003) that differentiate between HE Level 3 (final year undergraduate) and HE Level 4 (Master's level)

Learning Descriptor category	*Learning Descriptor sub-heading*	*Undergraduate final year (HE Level 3)* The learner:	*Master's level (HE Level 4)* The learner:
Development of Knowledge and Under-standing (subject specific)	*Knowledge base*	has a comprehensive/ detailed knowledge of a major discipline(s) with areas of specialisation in depth and an awareness of the provisional nature of knowledge	has depth and systematic understanding of knowledge in specialised/ applied areas and / across areas and can work with theoretical / research-based knowledge at the fore front of their academic discipline
	Ethical issues	is aware of personal responsibility and professional codes of conduct and can incorporate a critical ethical dimension into a major piece of work	has the awareness and ability to manage the implications of ethical dilemmas and work pro-actively with others to formulate solutions
Cognitive/ Intellectual skills (generic)	*Analysis*	can analyse new and/or abstract data and situations without guidance, using a range of techniques appropriate to the subject	with critical awareness can undertake analysis of complex, incomplete or contradictory areas of knowledge communicating the outcome effectively

Learning Descriptor category	*Learning Descriptor sub-heading*	*Undergraduate final year (HE Level 3)* The learner:	*Master's level (HE Level 4)* The learner:
Key /transferable skills (generic)	*Group Working*	can interact effectively within a team / learning / professional group, recognise, support or be proactive in leadership, negotiate in a professional context and manage conflict	can work effectively with a group as leader or member. Can clarify task and make appropriate use of the capacities of group members. Is able to negotiate and handle conflict with confidence
	Communications	can engage effectively in debate in a professional manner and produce detailed and coherent project reports	can engage confidently in academic and professional communication with others, reporting on action clearly, autonomously and competently
Practical skills (subject specific)	*Autonomy in skill use*	is able to act autonomously, with minimal supervision or direction, within agreed guidelines	is able to exercise initiative and personal responsibility in professional practice

1The full set of SEEC level descriptors involves 17 categories under these four overarching headings.

4. Literature review

As a starting point to this study and as a backdrop to the evaluation of students' experiences of interdisciplinarity in taught Master's courses, a review was undertaken of the diverse research and policy literature on student learning experiences, generic issues around interdisciplinary learning and IDL considered explicitly at postgraduate level. Synthesis of this literature allowed the verification of several key themes for further exploration. These included:

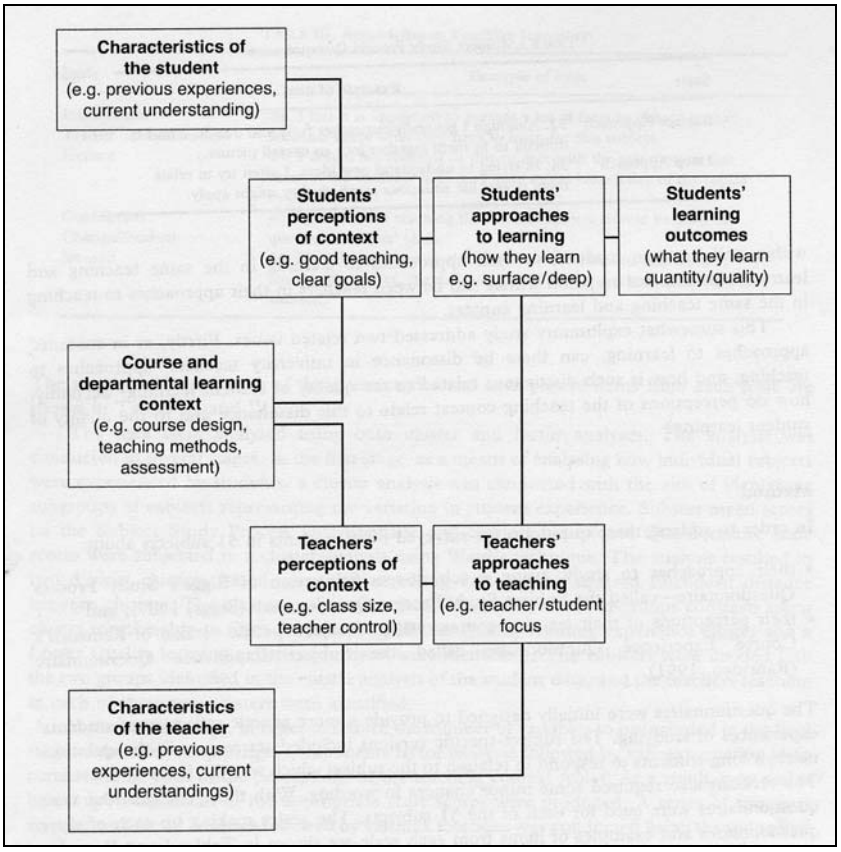
- The framework for evaluating student learning experiences (at any level);
- Definitions of disciplinary versus interdisciplinary learning;
- The nature of interdisciplinary education including issues associated with moving learning beyond the discipline;
- Interdisciplinary learning at postgraduate level;
- Learning styles for interdisciplinary learning;
- SWOT analysis of interdisciplinarity in learning;
- Learning outcomes associated with interdisciplinary learning and issues associated with assessment;
- The character of IDL communities in contrast to those that pertain in disciplinary contexts;
- IDL in an Education for Sustainable Development (ESD) context - to identify if there are distinct issues in sustainable development courses compared with other interdisciplinary courses.

It should be noted that the Higher Education Academy has already commissioned a review on interdisciplinarity (Chettiparambil Rajan, 2007). The current report draws on and acknowledges this document as appropriate.

4.1 Student learning experiences

Students' learning perspectives integrate a number of elements (see Prosser et al.'s, 2003 overview of student learning; Figure 1). These include the character of the student, the course and departmental learning setting, students' perceptions of the learning setting, their approaches to learning and learning outcomes. Also important are the character of staff and their perceptions and approaches to learning.

Figure 1: Overview of the student learning perspective – a model of student learning (Source: Prosser et al., 2003)



A number of researchers (e.g. Sterling, 2001, p. 15) have distinguished between first, second and third order learning (listing adapted from Selby, 2006):

- First-order learning is adaptive (about 'doing things better'), leaving basic values and assumptions unchallenged and unchanged.

- Second-order learning involves critically reflective learning where assumptions and perspectives are challenged and 'thinking out of the box' is encouraged. It is change-intentional ('doing better things').

- Third-order learning involves deep engagement with alternative world views, epistemologies and behaviours, necessarily involves a fundamental challenge to the way we see the world, and is transformative-intentional.

Prosser *et al.* (2003) have evaluated 'dissonant' engagement with learning among students and staff. They found that there is variation in the structural relationships between staff approaches to teaching and their perceptions of teaching context where students report higher and lower quality learning experiences. They identified lower and higher equality learning subjects or disciplines. Higher quality learning experiences were associated with subjects in which approaches to teaching are 'consonant and coherently related to the perceptions of teaching and learning context for the more senior staff in particular' (Prosser *et al*., 2003, p. 47).

Students' learning experiences will also depend on their preferred learning styles and approaches to learning (see Kolb, 1984). Awareness of personal learning styles enables students to develop personal learning strategies that will support them through their study into their careers. Awareness of the different learning styles present in a student cohort also helps tutors in managing the learning needs of a student group (see Fowler *et al.*, 2002). Kolb (1984) identifies four different categories of learning style based on where students sit on the axes of Concrete/ Abstract and Active/Reflective orientations (see Figures 2 and 3).

Figure 2: Characteristics of Kolb's Learning Styles (Healey et al., 2005; adapted from Kolb 1984, p. 86; Gibbs 1988, p. 20)

ACCOMMODATOR	DIVERGER
Active Experimentation and Concrete Experience (AE & CE) Can carry out plans Interested in action and results Adapts to immediate circumstances Trial and error approach Sets objectives and schedules Likes a practical, experiential approach	*Concrete Experience and Reflective Observation (CE & RO)* Imaginative and good at generating ideas Can view situations from many angles Open to experience Recognizes problems Investigates Senses opportunities Prefers to watch than act, and uses imagination to solve problems
CONVERGER	ASSIMILATOR
Abstract Conceptualization and Active Experimentation (AC & AE) Good at practical applications Makes decisions Focuses effort Evaluates plans Selects from alternatives Solves problems Prefers technical tasks	*Reflective Observation and Abstract Conceptualization (RO & AC)* Able to theorize Compares alternatives Defines problems Establishes criteria Formulates hypotheses Takes a concise logical approach Prefers a good explanation to a hands on experience

Figure 3: Concrete/ Abstract and Active/Reflective orientations of academic fields (from Kolb 1984, p. 127)

Felder (1996) summarised four types of learners in Kolb's classification scheme and the role of staff as facilitator as follows:

- *'Type 1 [Diverger] (concrete, reflective*). A characteristic question of this learning type is "*Why?*" Type 1 learners respond well to explanations of how course material relates to their experience, their interests, and their future careers. To be effective with Type 1 students, the instructor should function as a *motivator*.

- *Type 2 [Assimilator] (abstract, reflective)*. A characteristic question of this learning type is "*What?*" Type 2 learners respond to information presented in an organized, logical fashion and benefit if they have time for reflection. To be effective, the instructor should function as an *expert*.

- *Type 3 [Converger] (abstract, active*). A characteristic question of this learning type is "*How?*" Type 3 learners respond to having opportunities to work actively on well-defined tasks and to learn by trial-and-error in an environment that allows them to fail safely. To be effective, the instructor should function as a *coach*, providing guided practice and feedback.

- *Type 4 [Accommodator] (concrete, active*). A characteristic question of this learning type is "*What if?*" Type 4 learners like applying course material in new situations to solve real problems. To be effective, the instructor should stay out of the way, maximizing opportunities for the students to discover things for themselves'. (Felder 1996, p. 18).

Kolb's (1984) method of assessing preferred learning style has been used to appraise the dominant learning style of undergraduates in different discipline areas. For example, Healey *et al.* (2005) made international comparisons in learning styles of undergraduate geographers. They found 45% assimilators; 24% convergers; 14% accommodators and 17% divergers but also found intra-national and international variation.

4.2 Disciplinary v. interdisciplinary learning – defining the terms

There is considerable lack of precision in the research and practitioner literature about what the terms 'interdisciplinarity' vis-à-vis 'multidisciplinary' actually mean or their implications for learning or research (see Table 3 for a few examples). The term 'transdisciplinarity' is also used in a variety of ways. 'Interdisciplinarity' is also sometimes used as an overarching term for multidisciplinary and transdisciplinary research and learning activity.

Table 3: Defining the terms: interdisciplinary, multidisciplinary, transdisciplinary and pluridisciplinary

Term	*Definition*	*Source*
Interdisciplinary approach	Involves the use of an innovative conceptual framework to synthesise and modify two or more disciplinary approaches to deal with a research problem	Graybill *et al.* (2006)
Interdisciplinary learning	'is characterized by the integration of multidisciplinary knowledge across a central program theme or focus'	Ivanitskaya *et al.* (2002) p. 95.
Interdisciplines	'literally means 'between disciplines', i.e., between the bodies of knowledge defined by the theories and methods of established disciplines.'	Karlqvist 1999, p.379)

Term	*Definition*	*Source*
Interdisciplinary	'An adjective describing the interaction among two or more different disciplines. This interaction may range from simple communication of ideas to the mutual integration of organizing concepts, methodology, procedures, epistemology, terminology, data and organization of research and education in a fairly large field.'	OECD, 1972, cited in Chettiparambil Rajan, 2007 (p. 34)
An 'interdisciplinary' group	'consists of persons trained in different fields of knowledge (disciplines) with different concepts, methods and data and terms organized into a common effort on a common problem with continuous intercommunication among the participants from the different disciplines.'	OECD, 1972, cited in Chettiparambil Rajan, 2007 (p. 34)
Multidisciplinary approach	Involves researchers from two or more disciplines working collaboratively on a common problem, without modifying disciplinary approaches or developing synthetic conceptual frameworks	Graybill *et al.* (2006)
Multidisciplinary	Juxtaposition of various disciplines, sometimes with no apparent connection between them. e.g. music and mathematics and history	OECD, 1972, cited in Chettiparambil Rajan, 2007 (p. 34)
Transdisciplinary	Involves non-academic practitioners working with academics to identify, research and develop solutions to real world problems	Graybill *et al.* (2006) Tress *et al.* (2003)
Transdisciplinary	Establishing a common system of axioms for a set of disciplines (e.g. anthropology considered as 'the science of man and his accomplishment')	OECD, 1972, cited in Chettiparambil Rajan, 2007 (p. 34)
Pluridisciplinarity	A juxtaposition of disciplines assumed to be more or less related: e.g. physics and mathematics	Salter and Hearn (1997)

Nissani (1997, p. 3) proposes that 'a discipline can be conveniently defined as any comparatively self-contained and isolated domain of human experience which possesses its own community of experts'. In contrast, Nissani visualises interdisciplinarity as drawing bringing together distinctive elements of two or more disciplines.

> 'In academic discourse, interdisciplinarity typically applies to four realms: knowledge, research, education, and theory. Interdisciplinary knowledge involves familiarity with components of two or more disciplines. Interdisciplinary research combines components of two or more disciplines in the search or creation of new knowledge, operations, or artistic experience. Interdisciplinary education merges components of two or more disciplines in a single program of instruction. Interdisciplinary theory takes interdisciplinary knowledge, research, or education as its main objects of study' (Nissani, 1997, p. 3).

Definitions of 'interdisciplinary' will depend of course on personal conceptions of the character of 'disciplines' as its building blocks. Squires (1992) argues that:

> 'the notion that all disciplines conform to a standard model or set of criteria has been undermined both by multi-dimensional macro models of knowledge, and by the micro analysis of the internal nature and culture of disciplines. A non-standard or variable conception of disciplines will lead to a non-standard model of interdisciplinarity, since if disciplines can be constituted in differing ways, so also can the relationships between them. When we explore interdisciplinarity, therefore, we are exploring not a single or standard phenomenon, but a range of phenomena, with a diversity of rationales, forms, outcomes and problems' (Squires, 1992, p. 204).

Hansson (1999, p. 339) also refers to the 'multiplicity of expectations' of IDL, which, he argues, require us to 'increase our definitional rigour'. Indeed, Lattuca (2001) also notes that definitions of interdisciplinarity are challenging because of its transient nature:

> 'Interdisciplinarity is hard to define because it takes on so many guises and because it is a moving target that responds to expansions and contractions in the disciplines themselves. Grounded definitions of interdisciplinary scholarship enhance our understanding of interdisciplinary scholarship because they capture interdisciplinarity in practice. And, since practices evolve, our understandings of interdisciplinarity must also evolve over time' (Lattuca, 2001, p. 261).

Some writers also see the distinction between disciplinary and interdisciplinary learning as a transition. Selby (2006, p. 58) when considering IDL in an ESD context comments: 'Just as infusion can blur into the interdisciplinary, so can the interdisciplinary morph into the trans-disciplinary'.

4.3 Disciplines and disciplinary learning

Disciplines can therefore be defined or constructed in a wide variety of terms (see Squires, 1992; Bauer, 1990; Bradbeer, 1999) including:

- how they establish their identities;
- define and maintain their boundaries;
- disciplinary concepts;
- theoretical approaches and cognitive structures;
- understandings of knowledge;
- deal with internal disciplinary debates;
- epistemic stance and methodologies;
- languages and means of communication within their disciplinary community and beyond;
- perceptions of the world; and
- 'such apparently unrelated matters as political affiliation and style of behaviour '(Bauer, 1990 p. 110).

> 'Far from there being a single, standard theoretical or conceptual structure, one finds all sorts of internal 'maps': a tight theoretical core, with applied offshoots; a number of parallel 'spines'; a set of Venn-like overlapping fields; a matrix of intersecting problems and methods; a loosely related set of sub-fields. The 'unity' of the discipline may lie variously in its theory, its field or focus, its methodology, its technology, its professional organisation, its culture and shared norms' (Squires, 1992, p. 203).

Becher and Trowler (2001) have already identified that University disciplines act as de facto cultures, defined through 'sets of shared meanings or understandings about a group or organisation and its problems, goals, and practices' (Lattuca, 2001 p. 35; see also Bauer, 1990).

> 'By seeing disciplines as cultures, one recognizes that a field or subject—its knowledge, methods, theoretical approaches—cannot be separated from its practitioners. Outsiders cannot properly practice an intellectual discipline just as foreigners find it difficult to assimilate into a national culture' (Bauer 1990, p. 110 in Lattuca, 2001 p. 35).

Squires (1992) acknowledges that even 'shared norms' can vary between different disciplines:

> 'with some disciplines exhibiting a powerful, dominant culture, others appearing as a set of sub-cultures which co-operate, conflict or compete to varying degrees, and others again existing in a state of permanent, dynamic tension (witness the eternal 'crisis' in sociology). The strongest disciplines seem to be those which are unified in not one but several ways: theoretically, methodologically, professionally and culturally. But even the notion of strength varies: some are strong and imperialistic (physics); some are strong and pervasive (computing); some are strong and absorptive (history); some are strong and self-contained (law)' (Squires, 1992, p. 203).

Becher (1989) also identified four basic dimensions for classifying disciplines:

- hard-soft;
- pure-applied;
- convergent-divergent;
- urban-rural (density of researchers to research problems).

Becher's classification of disciplines on these criteria is provided in Table 4.

Table 4: A classification of disciplines (after Becher, 1989 in Bradbeer, 1999)

Hard	*Hard rather than soft*	*Intermediate*	*Soft*
Physics Chemistry Mathematics	Biology Engineering	Economics Geography	History Sociology Law
Convergent	*Quite convergent*	*Intermediate*	*Divergent*
Physics History	Mathematics Economics	Law Chemistry Biology	Sociology
Multidisciplinary: Geography			

From a pedagogic perspective, there are also varying relationships between research and teaching in different disciplines and the extent that research informs teaching, and vice versa. For example, some disciplines are characterised by the lone researcher (e.g. humanities) while others have group approaches to research and teaching (e.g. the environmental sciences).

4.4 Interdisciplinary learning (IDL)

4.4.1 Nature and focus of interdisciplinary learning

Interdisciplinarity manifests itself in different ways across a range of postgraduate education from PGT to PGR. The clusters of discipline areas manifest in IDL can vary. For example, Selby (2006, p. 58), in the context of interdisciplinary approaches to ESD, highlights the difference between 'contiguous or proximate' and 'non-contiguous or non-proximate' interdisciplinarity. The former is where subjects like geography, environmental sciences and biological sciences are linked in IDL while the latter involves IDL linking disciplines with larger philosophical distance, such as 'agriculture and fine arts or psychology and environmental sciences'.

There are certain common characteristics of interdisciplinary courses (see Table 5), including their dealing with complex methodologies or concepts that draw across different discipline areas and problem-orientated foci. Several texts note that real problems are not neatly solved by problem-solving within disciplines and the mismatch with University academic structures.

> 'The world has problems but Universities have departments' (Brewer, 1999, p. 328).

Table 5: Characteristics of the focus of interdisciplinary courses

Characteristic (and level)	*Setting*	*Source*
Engage with complex issues	PGR in urban ecology	Graybill *et al.*, (2006)
'To investigate real-world issues'	PGR in urban ecology	Graybill *et al.*, (2006)
Area- or problem-based (e.g. European Studies or urban development)	General	Becher and Kogan (1992)
Involve integrative experiential learning	Adult education	Dinmore, 1997

The foci of interdisciplinary taught postgraduate courses frequently have strong links to interdisciplinary research activity that addresses themes or problems requiring an interdisciplinary approach to their solution.

Other themes that are reflected in the literature on interdisciplinary learning include:

- *Value of prior knowledge and skills.* The recognition and validation of prior knowledge, much of which may be tacit, is central to both confidence and further learning.

- *Personalisation of learning.* 'Interdisciplinary approaches encourage students to perceive the connections between seemingly unrelated domains, thereby facilitating a personalized process of organizing knowledge' (Ivanitskaya *et al.* 2002, p. 99).

- *Transitions to interdisciplinary learning.* There are various pathways to IDL and these require crafting and support from the initial stages of learning. Similarly there are various pathways to interdisciplinary research and training and three main stages, comprising naissance (Where is my home?); navigation (What do I prioritize?); and maturation (How do I integrate and represent my scholarship?) (Graybill *et al.*, 2006, pp. 759-760). The IDL approach also needs to be made explicit for success in learning and also requires participants to take different views of 'the truth' as illustrated in the two quotes below.

  'It is both within the process and product of the curriculum, and from the very beginning (i.e. induction) that the nature, value and necessity of interdisciplinarity needs to be made [sic], both implicitly and explicitly. The approach needs to be overt, covert and integrated in order to be successful' (Dalrymple and Miller, 2006, p. 30).

  'Students who have grown up with a disciplinary paradigm need to move from absolute to parallel truths and knowledge. They need to take on different views of 'the truth' and accept that different people in a discipline have different views' (Dalrymple and Miller, 2006, p. 30).

- *The nature of intellectual communities.* It has also been argued that disciplinarity and interdisciplinarity form dual intellectual communities (Graybill *et al.*, 2006).

4.4.2 Learning styles and ID

Different disciplines have different dominant learning styles among both students and tutors (see Section 4.1). These may form one of the barriers to the development of effective interdisciplinarity learning communities (Bradbeer, 1999). Bradbeer (1999) sees the problems in achieving interdisciplinarity in student learning in three ways:

- 'problems in working across disciplines',
- 'problems of working in different disciplines' and
- 'problems in synthesising different disciplines' (Bradbeer, 1999, p. 382).

He explains these problems in terms of differences in students' preferred learning styles and approaches and the traditions of teaching and learning as well as disciplinary epistemologies and discourses.

4.4.3 Learning outcomes associated with interdisciplinary learning

As interdisciplinary learning can draw across a range of disciplines, learning outcomes focus on higher order intellectual or 'metacognitive' skills and personal skills and extend beyond abstract intelligence to application and 'integrated learning'. Ivanitskaya et al. (2002) provide a useful synthesis of the predicted learning outcomes from interdisciplinary courses (Table 6).

Table 6 Predicted outcomes of interdisciplinary programmes (Ivanitskaya *et al.*, 2002, p. 100)

Author	*Outcome*
Ackerman (1989)	• Flexible thinking • Ability to generate analogies and metaphors • Understanding of the strengths and limitations of disciplines • Ability to assess value to knowledge gained
Ackerman & Perkins (1989)	• Enhanced thinking and learning skills • Improved higher-order cognitive skills • Improved content retention • Capacity for proactive and autonomous thinking skills • Ability to devise connections between seemingly dissimilar contexts
Field, Lee and Field (1994)	• Ability to tolerate ambiguity or paradox • Sensitivity to the ethical dimensions of issues • Enlarged perspectives and horizons • Ability to synthesize or integrate • Enhanced creativity, original insights or unconventional thinking • Enhanced critical thinking • Capacity to perceive a balance between subjective and objective thinking • Humility, sensitivity to bias, and empowerment • Ability to demythologize experts

In addition, Ivanitskaya *et al.* (2002, p. 95) argue that:

> 'with repeated exposure to interdisciplinary thought, learners develop more advanced epistemological beliefs, enhanced critical thinking ability and metacognitive skills, and an understanding of the relations among perspectives derived from different disciplines'.
>
> 'Interdisciplinary approaches, while arguably less effective than traditional approaches for building the depth of single-subject knowledge, emphasize higher-order thinking (e.g. analyzing, applying, generalizing) and seek meaningful connections between and among disciplines' (Ivanitskaya *et al.*, 2002 p. 97).

Dalrymple and Miller (2006) make important links between interdisciplinary ways of thinking and the skills for employability:

> 'Interdisciplinarity encourages 'multilogical' thinking - the ability to think accurately and fair-mindedly within opposing points of view and contradictory frames of reference. It is exactly these high level analytical skills that employers are often looking for rather than a discipline-specific expertise' (Dalrymple and Miller, 2006, p. 31).

Ivanitskaya *et al*., (2002, p. 108) apply an adaptation of Biggs and Collis' (1982) *Structure of the Observed Learning Outcome* to illustrate the different stages of interdisciplinary knowledge integration, from acquisition of single-subject procedural knowledge to transfer of generalised knowledge to interdisciplinary topics, issues or problems. The model also suggests how interdisciplinary learning facilitates specific learning outcomes, including interdisciplinary content thinking, reasoning skills, epistemology, and metacognition (see Table 7).

Table 7: Application of Biggs and Collis' (1982) Structural Model to Interdisciplinary learning (source: Ivanitskaya *et al*., 2002, p. 108)

Structural Level	*Description within a context of interdisciplinary learning*	*Outcomes*
Uni-structural (uni-disciplinary)	Learner focuses on a relevant discipline.	Declarative and procedural knowledge in one discipline
Multi-structural (multidisciplinary)	The learner acquires knowledge in several disciplines but does not integrate them.	Declarative and procedural knowledge in several disciplines that are related to a central theme, multidisciplinary thinking
Relational (inter-disciplinary, limited to one central theme or problem)	The learner integrates knowledge from several disciplines around a central theme. Critical thinking skills are being developed as the learner becomes aware of the strengths and limitations of the perspectives offered by each discipline.	Interdisciplinary content thinking (declarative and procedural knowledge); critical thinking skills; some metacognitive skills; advance epistemological beliefs
Extended abstract (interdisciplinary, extended to other themes or problems)	The learner acquires a knowledge structure that integrates interpretive tools (methodologies, theories, paradigms, concepts, etc.) from multiple disciplines. The learner uses metacognitive skills to monitor and evaluate his or her own thinking processes. The learner applies an interdisciplinary knowledge structure to new interdisciplinary problems or themes.	A well-developed interdisciplinary knowledge structure; interdisciplinary content thinking; critical thinking skills; metacognitive skills; highly advanced epistemological beliefs; transfer of interdisciplinary knowledge.

For Ivanitskaya *et al.* (2002, p. 108), 'students engaged in interdisciplinary programs are more likely to acquire integrated perspectives and solution-focused strategies, rather than content-specific knowledge derived from a single discipline'. Some learning outcomes are predictable; others may be less so. Field and Stowe (2002, p. 264) highlight the problem in trying to describe the expected learning outcomes of a course or assessment in 'non-utopian language while leaving room for discovery of unanticipated outcomes'.

4.4.4 Assessment and IDL

The HE Academy review of IDL cites the work of Field and Stowe (2002) on assessment (Chettiparambil Rajan, 2007). They note the challenge of:

- Finding 'a fit in the typically linear assessment arena for creative, interdisciplinary programmes seeking complex cognitive, developmental and serendipitous outcomes;
- Defining the core interdisciplinary construct of synthesis or integration in a measurable manner;
- Identifying both conventional and creative assessment techniques for gathering data on interdisciplinary learning;
- Keeping the focus of assessment on improving cognitive, affective, and
- Developmental outcomes, thus improving interdisciplinary curricula and pedagogy' (Field and Stowe, 2002, p. 264).

They emphasise the role of teaching staff in the assessment environment and propose that for effective learning and teaching that the assessment programme 'should be locally developed and must reflect teaching staff's own understanding of interdisciplinarity which might be an evolving one' (Field and Stowe, 2002, p. 264). Toynton (2005) echoes this suggesting that assessment for interdisciplinary courses can be resource intensive, as more than one tutor may need to be present on all taught sessions and input into the assessment of student work, 'since the tutors also need to develop and share their interdisciplinary perspectives' (Toynton, 2005, p. 111).

Field and Stowe (2002) articulate the detailed principles for assessment (Field and Stowe 2002, pp. 270-271). Examples include:

- Identifying the scope of the interdisciplinary assessment plan. Field and Stowe (2002) cite that AIS Assessment Study Committee was at the time considering a recommendation that interdisciplinary assessment should include at least four elements. These were: (a) 'intended and serendipitous learner outcomes in the cognitive, affective and developmental domains'; (b) interdisciplinary curriculum design and implementation; (c) interdisciplinary pedagogy; and (d) program context.

- Defining expected outcomes in measurable terms but also anticipating unexpected or serendipitous outcomes. They argue that the assessment strategy must acknowledge that no assessment plan will ever cover all learning outcomes.

4.5 Interdisciplinary learning at postgraduate level

Although the focus of this report is on student experiences of interdisciplinarity in postgraduate taught courses, discussions about the character of interdisciplinary research and the comparative learning experiences of research students focusing on interdisciplinary topics both have relevance. Although these links may be stronger in the teaching and learning of postgraduate research students, Master's courses frequently link to, or draw on, the research expertise of staff.

4.5.1 Interdisciplinarity in research – relationships to PGT and course foci

The strategic development of research activity in the UK and internationally since the 1990s has involved a shift to increasing interdisciplinarity, driven by the growing realisation that major research problems frequently need integrated disciplinary expertise. There are important links between this move and the increased number of interdisciplinary PGT courses, particularly in the 'old' University sector. This is despite the fact that interdisciplinary research is not easily recognised by the structure of the UK Research Assessment Exercise (RAE). Discussions in the research literature about interdisciplinary research undertaken by tutors and students also focus on the problems of definition and engagement as well as 'collaboration' and 'connection' (Table 8).

Table 8: The nature of interdisciplinary research

'Interdisciplinary research has become a familiar and popular concept. Its necessity and popularity are such that we sometimes lack precision in what the term and its associated activities actually mean and do. The step from an appealing idea to an operational method is large indeed. We must take a more detailed look before we leap' (Karlqvist, 1999, p. 379).
'Collaboration among researchers in multiple disciplines is the essence of interdisciplinarity' (Graybill *et al.*, 2006, p. 758).
'Interdisciplinary research thus requires an understanding of the disciplines themselves, as well as understanding of how to connect disciplinary knowledge. In effect, we seek a kind of metaknowledge' (Karlqvist, 1999, p. 379).

Karlqvist (1999, p. 381) proposes that interdisciplinary research requires an important understanding of both individual disciplines and the connection of their knowledge. He provides a five category scheme to describe the modes of interdisciplinary research:

- Mode 1: Unification of knowledge;
- Mode 2: Accumulation of knowledge;
- Mode 3: 'Knowledge from different areas is still compatible, but requires an additional amount of interpretation to be meaningful';
- Mode 4: 'a research realm where not only theories are different but so, also, are the basic underlying assumptions and paradigmatic bases for theories';
- Mode 5: 'where the repertoires of the theories and methods are different and where, in addition, one seeks knowledge from different cultures where fundamental interpretative and conceptual differences exist'.

Karlqvist (1999, p. 382) also notes how the progressive stages from Mode 1 to 5 capture not only the increasing distance between knowledge fields and their connection but also the changing character of that distance gap. He outlines the following changes in this character:

1. Doing the same thing in different ways;
2. Doing different things that can be combined;
3. Doing different things that cannot be combined absent (without) an additional framework;
4. Doing things differently;
5. Thinking differently.

The foci for interdisciplinary research are frequently linked to problem orientations and systems approaches to their analysis. 'Systems' comprise interrelated objects each with a number of measurable attributes while 'systems analysis' is defined as the study of systems that include both the human element and the behavioural relationships between that system's human element and its physical components. A key area of interdisciplinary research is the application of science (linking pure and applied) in the realms of decision-making and policymaking. Brewer (1999) notes the importance of systems analysis in research as an institutional arrangement for defining and solving environmental problems (see Section 4.6: ESD and ID). Levien (1997, p. 5) proposes that no matter the time, place or institution, four basic requirements persist for first-class systems analysis. These are:

1. Interdisciplinary teams comprising excellent disciplinary specialists participating under the integrative leadership of a talented leader;

2. A broad scope of work to enable the analysis to follow the problem wherever it leads;

3. Sufficient continuity of the relationship with the client to permit the analysts to develop a deep understanding of the client's organization and responsibilities and for mutual trust to develop; and

4. Enough independence from the client agency to be able to avoid succumbing to pressure to produce answers desired by one or another faction within the client organization.

This represents interdisciplinary research that is problem-oriented and applied work for real clients or customers.

4.5.2 The student learning experience in interdisciplinary learning at PGT level

Barriers to interdisciplinary learning

Brewer (1999) identifies common obstacles for tutors and students engaged in the process of interdisciplinary teaching and learning including:

- different cultures and frames of reference;
- different methods and operational objectives within and between the disciplines;

- different 'languages' within the disciplines and between the disciplines and the world at large;
- personal challenges related to gaining the trust and respect of others working in different disciplines and fields;
- institutional impediments related to incentives, funding, and priorities given disciplinary versus interdisciplinary work;
- professional impediments related to hiring, promotion, status, and recognition (after Brewer 1999, p. 335).

This list is incomplete but suggests that there are many areas worth exploring if the ultimate goals are to recognise and understand such obstacles in context of the student learning experience so as to overcome them. Other barriers include temporary or permanent loss of disciplinary home and loss of professional identity. Some barriers may be real while others may be perceived.

Postgraduate student experiences - transitions to interdisciplinary learning

The transition phase to postgraduate study is normally considered the first three months, frequently characterised by an early induction to taught postgraduate learning normally at the start of study. There is limited research literature exploring issues in the transition to postgraduate level interdisciplinary learning. More generic research, however, suggests that postgraduate students' experiences during the early period at the start of a new course can be critical for later student success. There are a number of generic observations on 'transitions' to effective learning that can generate questions within interdisciplinary learning. These include:

- that 'mere exposure to a discipline culture is not enough for most students to become fully participating members'. Here the focus was on research students (Adams and Zander, 2004, p. 1). Does the same apply to interdisciplinary cultures?

- 'the importance of good extra-cultural exchanges with peers, the community and teaching staff'. Here Guilfoyle and Halse (2004) were exploring international students' transitional experiences. How does the effectiveness of interdisciplinary communication impact on the learning experiences of students from different disciplinary groups?

- 'evidence that academic success is strongly related to wellbeing of the student. Particular pressures are apparent in the first months related to the adaptation to new cultural, linguistic and learning environments'. Schevens *et al*., (2003, p. 310) were studying impediments to learning experiences in international students pursuing postgraduate study in geography. Is the transition period similarly critical for students on interdisciplinary students?

4.6 Education for sustainable development (ESD) and IDL

Environmental problems have already been identified as a key focus for IDL (Section 4.4.1). This section reflects on learning and teaching in an SD/ESD context and appraises the synergies with IDL.

4.6.1 SD and ESD - The concept and focus

There is a growing research and policy literature about ESD and the knowledge and skills set required for effective practitioners in national and regional economy (see Baines et al., 2005; Martin et al., 2006). Loosely defined, 'sustainability' is the aspiration or goal; 'sustainable development' (SD) is the process and 'education for sustainable development' (ESD) is the capacity building among stakeholders to contribute to the sustainable development process. 'Sustainability' is a challenging concept for students to understand as is the term 'sustainable development'. Magnier (2006) has discussed reasons why and finds this is due primarily to difficulties with the diversity of definitions. She argues that to overcome this, students must first personalise the concept of sustainability and make it relevant to their own lives. The next step is to adopt an interdisciplinary approach to teaching sustainability.

For Selby (2006): 'sustainability, with its many interrelated dimensions, defies disciplinary containment while each disciplinary culture is likely to be receptive to some, but not all, dimensions' (Selby, 2006, p. 57).

4.6.2 Sustainability in an IDL research context

The theme of sustainability has already been used by some authors to highlight the characteristics of interdisciplinarity. For example, Karlqvist (1999) uses sustainability in differentiating what he describes as mode 3 of interdisciplinary research where 'knowledge from different areas is still compatible, but requires an additional amount of interpretation to be meaningful' and to emphasise the importance of systems analysis (see Section 4.5.1 on IDL research).

> 'Sustainability is a key issue on the environmental research agenda. We can approach the problem of a sustainable society by studying the circulation of resources. An economist would focus on the flow of money, goods, and services through the system. An ecologist would be drawn to energy flows. Money flows - energy flows, how to reconcile these two aspects of the same problem? A new theoretical framework is required, one that goes beyond what the economist or the ecologist alone is capable of providing. There is no general method available to combine such knowledge, although techniques exist to facilitate and assist. Formalized models, computer software, and even structured but less formal procedures have been created and used over the years for this purpose. Operations research and systems analysis each provide an orderly way of communicating between disciplines and fields, although neither is usually capable of judging who is 'right.' (Karlqvist 1999, p. 381)

4.6.3 Approaches to learning and teaching in ESD

Kagawa *et al.*, (2006, p. 53) emphasise the need for pedagogy adopted to 'harmonise' with sustainability 'precepts and principles'. They cite Wals and Jickling (2002, p. 229) and the various shifts necessary in ESD methodologies:

- from consumptive learning to discovery learning and creative problem solving;
- from teacher-centred to learner-centred arrangements;
- from individual learning to collaborative learning;
- from theory-dominated learning to praxis-oriented learning;
- from sheer knowledge accumulation to problematic issue orientation;
- from content-oriented learning to self-regulative learning;
- from institutional staff-based learning to learning with and from outsiders;
- from lower level cognitive learning to higher level cognitive learning;
- from emphasizing only cognitive objectives to also emphasizing affective and skill-related objectives).

Selby (2006) identifies three different approaches to ESD – infusionist, interdisciplinary and transdisciplinary. He then outlines four interdisciplinary approaches to ESD, with varying degrees of sophistication and potential for depth of learning:

- *Sustainability-related interdisciplinary programmes*. Here the team teaching elements are highlighted with tutors representing a range of discipline areas. The role of the tutors is seen as central.

  'Team members can work in relative isolation from each other, with consequent loss of third-order learning potential, or they can work together to foment dynamic learning contexts rich in fundamental challenges to assumptions, perspectives and world views' (Selby, 2006, p. 58).

- *Cross-fertilisation approach*. This involves 'a loosening of the disciplinary frame by building in inputs from other disciplines into subject-based programmes' (p. 58).

- *Case-study approach* 'This extends the case study approach as already described but also establishes structures and spaces so that academics and students can work co-jointly on interpreting the case, sharing their understandings of the case and, in the wake of the interaction, working on embedding received insights from other disciplines into their own understandings' (p. 58).

- *Special event approach* Here 'academic staff and students from a range of disciplines engage in co-learning around sustainability related themes' (p. 58).

Selby (2006) argues strongly for an interdisciplinary approach to delivering on ESD. While engaging with the sustainability agenda involves 'deep personal and professional challenge' (p. 58), remaining solely within a discipline setting is only likely to encourage first and second order learning (see Section 4.1). He concludes with a paraphrase of Palmer (1998) that mirrors the quote about the mismatch between interdisciplinary problems and University Departments from Brewer (1999, p. 328; section 4.4.1):

> 'We have been great at thinking the world apart; what we need to do now is to think it back together.' (Selby, 2006, p. 59)

4.6.4 Learning outcomes for ESD and IDL

There are a number of papers that focus on skills required for effective ESD training for the professions, (e.g. Martin (2005) 'Sustainability, systems thinking and professional practice'; Martin and Jucker (2005) 'Educating earth literate leaders'.) Dawe et al. (2005) identified eleven techniques for embedding ESD into Higher Education including the promotion of 'holistic thinking through interdisciplinarity and critical thinking' and 'holistic thinking through systems analysis'. Table 9 maps the learning outcomes from IDL with the learning outcomes for sustainability literacy and demonstrates considerable commonality.

Table 9: Predicted learning outcomes of SD programmes mapped against those from interdisciplinary learning (in Table 5)

Author	*Outcome*	*Learning outcomes for ESD*
Ackerman and Perkins (1989)	• Improved higher-order cognitive skills	'Deep engagement with alternative world views, epistomologies and behaviours' (Selby, 2006, p. 58)
	• Ability to devise connections between seemingly dissimilar contexts	Appreciation of the interconnectedness of environmental, social, political and economic aspects of ESD (HE Academy, 2005, p. 6).
Field, Lee and Field (1994)	• Ability to tolerate ambiguity or paradox	Understanding of the contested notions of SD (HEA, 2006, p. 6).
	• Sensitivity to the ethical dimensions of issues	Ethical skills (Dawe *et al*., 2005)
	• Enlarged perspectives and horizons	Awareness of different cultures and lifestyles, and the global community (Dawe *et al*., 2005)
	• Ability to synthesize or integrate	Development of: "a more rounded student informed by ethics, philosophy, entrepreneurial skills, science, humanities and the environment" (Dawe *et al*., 2005)
	• Enhanced creativity, original insights or unconventional thinking • Enhanced critical thinking	Critical thinking (HE Academy, 2005)

In addition, in ESD there is strong evidence of a greater emphasis being placed on interdisciplinary, problem-solving capacity rather than a traditional and overly specialised scientific competence. It has been argued that geography with its long tradition of multidisciplinary approaches should be well-placed to lead this shift towards problem-centred rather than discipline-centred education (see Selby, 2006).

5. Research design and methodology

The study aimed to evaluate critically the learning experiences of taught postgraduate students on interdisciplinary Masters' courses with attention to four elements:

(a) the interaction of different discipline areas in interdisciplinary courses;
(b) the role of 'vocationality' as a unifying element in interdisciplinary course delivery; (c) the relative balance of theory and practice in interdisciplinary teaching; and
(d) the institutional setting.

The research methodology involved an in-depth study of eight taught Masters' courses with an interdisciplinary focus at two comparative case-study Universities from new and old University sectors - the University of Gloucestershire and the University of Dundee (see Table 10). For the purpose of this study and drawing from the literature review, an interdisciplinary course was defined as one which had the following characteristics:

- Aims and objectives that were interdisciplinary;
- An intake of students from interdisciplinary backgrounds;
- Taught by a team of tutors from different disciplinary or interdisciplinary backgrounds.

The Masters' courses were selected to represent the interaction of different discipline areas in interdisciplinary courses, differing balance between academic and vocational foci and varying emphasis on theory and practice. Student numbers on any one course tended not to be large so a greater number of courses were selected to try and ensure engagement with sufficient students.

Table 10: Taught postgraduate (PGT) courses targeted within the project

Course	*Disciplinary groupings*
MSc in Tourism and Sustainable Development (UoG)	Environment, Tourism, Geography
MSc Environmental Policy and Management (UoG)	Environmental science, Policy, Business
MA Film and Media (UoG)	Film, Media, Audience studies
MA Research Methods (UoG)	Range of discipline areas; [1] (Arts & Humanities, Countryside Planning, Earth Sciences, Education and Social Sciences, Human Geography and Sport and Leisure)
MSc Managing Environmental Change (Dundee; run jointly with St Andrews University)	Biology, Environmental sciences, Law, Business, Geology, Geography
MSc Remote Sensing (Dundee)	Electronic engineering, Physics, Geography, Computing

[1] The MA/MSc in Research methods comprised of 6 named routes providing generic and specific research methods training, with all students regardless of route coming together to take a compulsory interdisciplinary module, *RR401 Introduction to Research.*

Course	*Disciplinary groupings*
MSc Globalisation: Origins, Development and Contemporary Impact (Dundee)	Economics, Politics, Business, History, English
MLitt Women, Culture and Society (Dundee)	English, Film History and Philosophy and the University's Archive and Visual Research Centre

After the initial literature review reported above, there were four integrated stages to the methodology.

Stage 1: Questionnaire Survey

A questionnaire survey was developed for distribution to students studying on these different postgraduate interdisciplinary courses at the two participating HEIs. The target was a response from 50 students.

Before constructing the questionnaire survey, there was an initial trawl of previous questionnaires developed to evaluate both:

- The student learning experience more generically; and
- The learning experiences of those involved in interdisciplinary or interprofessional learning.

These included:

- The *Experiences of Teaching and Learning questionnaire* (ESRC funded 'Enhancing Teaching and Learning Environments in Undergraduate Courses (ELT) project, Entwistle, 2003);
- The Higher Education Academy's 2007 survey of *Postgraduate Research Experience Survey* (PRES) led by University of Bristol; and
- Several surveys of students' experiences of interprofessional learning from the UK and US (e.g. The University of Aberdeen/ The Robert Gordon University *Readiness for Interprofessional Scale* (RIPLS) Questionnaire; The University of Nebraska National Health Service Corps *Student/ residents' experiences*; El Ansari *et al*., 2002)

The questionnaires differed in their levels of theoretical underpinning; in particular previous questionnaires to appraise the interprofessional learning experience tended to be practically orientated. The actual questions selected for the questionnaire in this project were developed from the research themes identified in the literature review. The questionnaire had 98 questions, with a mix of quick response questions using the Likert scale and open ended questions that allowed more discursive answers. The questions focused on and integrated the following themes:

(a) ***The existing knowledge, understanding, abilities, motivations and conceptions/ styles of learning that students have from their disciplinary homes and how this is brought to a postgraduate co-learning environment.***

- Student expectations of interdisciplinary learning at outset;
- Implications of the student's prior disciplinary base and student support needs in the transition to interdisciplinary learning.

(b) *How postgraduate students in interdisciplinary masters' courses perceive the teaching-learning environment*

- Student perceptions of interdisciplinary learning at different stages in their study;
- A 'student perceived' SWOT analysis of an interdisciplinary learning environment.

(c) *How postgraduate students approach learning and studying in an interdisciplinary context.*

- Students' approaches to learning in an interdisciplinary course;
- Students' learning outcomes in an interdisciplinary course (quantity and quality of what they learn);
- The character and opportunities for student co-learning at postgraduate level in an interdisciplinary context

(d) *Students' learning outcomes in an interdisciplinary learning context*

- Students' reflections on the quantity and quality of what they learn (key knowledge and skills).

The questionnaire themes as presented to the students are outlined below:

Table 11: Themes considered in the student questionnaire

Theme 1: Student expectations of interdisciplinary learning
• Previous learning experience
• Learning styles in previous undergraduate degree
• Transition to present learning experience
Theme 2: Perceptions of the teaching-learning environment at PGT level
• Student general perceptions of their postgraduate course
• Experiences of teaching and learning
Theme 3: Approaches to learning and studying in an interdisciplinary context.
• Knowledge/ methods areas particularly suited to interdisciplinary learning
• Learning styles associated with current taught postgraduate course
• Perceptions of co-learning environments for staff and students
Theme 4: Demands made by a new interdisciplinary course
Theme 5: Vocationality and interdisciplinary courses
Theme 6: Learning outcomes - what you have learned?
Assessment of general course satisfaction

The questionnaire was designed for web-based delivery using Questionmark, a software programme enabling efficient questionnaire design and distribution. The survey was uploaded onto a server that was easily accessible via a weblink. The weblink to the Questionmark survey was emailed to students by the project gatekeeper for each institution and then forwarded on to the students by the relevant course tutor. Student responses to the questionnaire were recorded in an Excel spreadsheet for analysis.

The questionnaire was analysed using descriptive statistics and histograms. Responses were subdivided between Master's courses with a sustainable development (SD) focus and other interdisciplinary courses to allow comparison in line with the project aims. In addition, there was further qualitative analysis of students' responses including a SWOT analysis.

Stage 2: Student focus groups

Focus groups were then used to complement and extend the student questionnaire survey and allow exploration and in-depth discussions on specific themes revealed in the latter. The focus groups also considered whether there are distinct issues in the character of student learning experiences in courses with a sustainable development focus vis-à-vis other interdisciplinary courses. The focus group interview schedule consisted of a series of open ended questions, developed from the identified project research themes and the experience of authors (McEwen, Jennings, Duck) of teaching interdisciplinary courses. The guide for the focus group included questions on:

- Learning styles (including fit with current course and dominant learning styles on course);
- Understanding of and reflections on 'interdisciplinarity';
- Transitions to interdisciplinarity at postgraduate level;
- Positives and negatives of studying an interdisciplinary course;
- The role of fellow students in interdisciplinary learning;
- The role of tutors in interdisciplinary learning;
- Opportunities for learning skills;
- Communication skills;
- Problem solving;
- Developing ways of thinking (including thinking holistically);
- Experience of assessment;
- The impact of interdisciplinary learning on professional practice;
- Interdisciplinary learning and ESD, including the impact on professional; practice in ESD (for sustainable development courses).

Two student focus groups were held at each participating institution (University of Dundee and University of Gloucestershire; i.e. four in total). Each focus group consisted of a group of students with at least two facilitators and lasted up to 1 hour 45 minutes. While the focus group facilitator(s) sought to ensure that all research themes were covered (see Appendix 2), they also sought to encourage general reflection on interdisciplinarity and learning and the identification of new research themes. The focus group proceedings were audio-recorded and transcribed. The transcripts were then analysed in relation to the identified research themes and other topics that emerged during the course of the focus groups.

Stage 3: Survey of staff

The final stage of the project methodology was a questionnaire for teaching staff on interdisciplinary postgraduate courses to complement the evidence about the students' learning experiences. As for the student focus group interview guide (see above), the staff questionnaire was made up of a series of open-ended questions, focussing on the following themes:

- The relationship between interdisciplinarity and student diversity;
- The overtness of interdisciplinarity in courses and learning activities;
- Positives and negatives for students on interdisciplinary courses;
- Opportunities for co-learning in interdisciplinary courses;
- The role of staff in interdisciplinary learning;
- Interdisciplinary learning and ESD, including the impact on professional practice in ESD (for sustainable development courses).

The questionnaire format is presented in Appendix 3. In addition, tutors were asked an additional question as requested by the project commissioners:

'Has interdisciplinarity diversified the cohort of students or/and has the diversity of students driven a move towards interdisciplinarity?'

The project gatekeepers initially emailed the questionnaire to members of staff teaching on the range of interdisciplinary postgraduate courses targeted for the student questionnaire survey at the two institutions. Participating staff emailed their completed questionnaires to the project research team. In the second phase and to increase the response rate, three further 'face to face' staff interviews were completed.

Stage 4: Analysis

This involved analysis and synthesis of the outputs from Stages 1-4, with attention to the following themes:

(a) The interaction of different discipline areas in interdisciplinary courses;
(b) The role of 'vocationality' as a unifying element in interdisciplinary course delivery; (c) The relative balance of theory and practice in interdisciplinary teaching; and
(d) The institutional setting.

Reflections on the research process

There were several issues in delivering on the research methodology. In stage 1, student surveys were completed from two cohorts - one over the period March to May 2007 and another in December 2007. The response rate to the questionnaire was disappointing, despite incentivising the activity with a prize draw. Thirty students contributed to the questionnaire survey (see Section 6.1 for more details of participants). The initial timing of the project was problematic with reference to the taught postgraduate student year and in accessing Master's students who were out of University completing their dissertation. In addition, many students were part-time and were already under time pressures to complete required course elements. Student cohorts for any course tended to be small and hence vulnerable to year-to-year variability in student numbers. Greatest success came from personal one to one requests from staff to respond.

Although the initial intention had been to make some comparisons linked to institutional setting ('old' versus 'new university'), it was not possible to do this quantitatively given the small questionnaire response from the University of Dundee. Nevertheless some qualitative observations can still be made on the basis of the evidence from both the questionnaire responses and the focus groups.

6. Results and discussion

The results presented here integrate evidence from the questionnaire survey of students, the student focus groups and the staff survey. Results are presented under the following headings and combine frequency histograms (see examples in Appendix 4) with selected quotes (in italicised boxes) to highlight the themes coming through in the surveys. Although the graphical displays in Appendix 4 did separate on SD and non-SD courses, this has not been explored in detail in the data analysis due to the small sample sizes. The results are accompanied by critical reflection on the evidence gathered.

6.1 Nature of the survey

6.1.1 Course and departmental learning context

The interdisciplinary courses surveyed varied in their character against the different types of PGT course provision identified in section 3.3 (see Table 12).

Table 13: Courses surveyed, disciplinary groupings and type of course

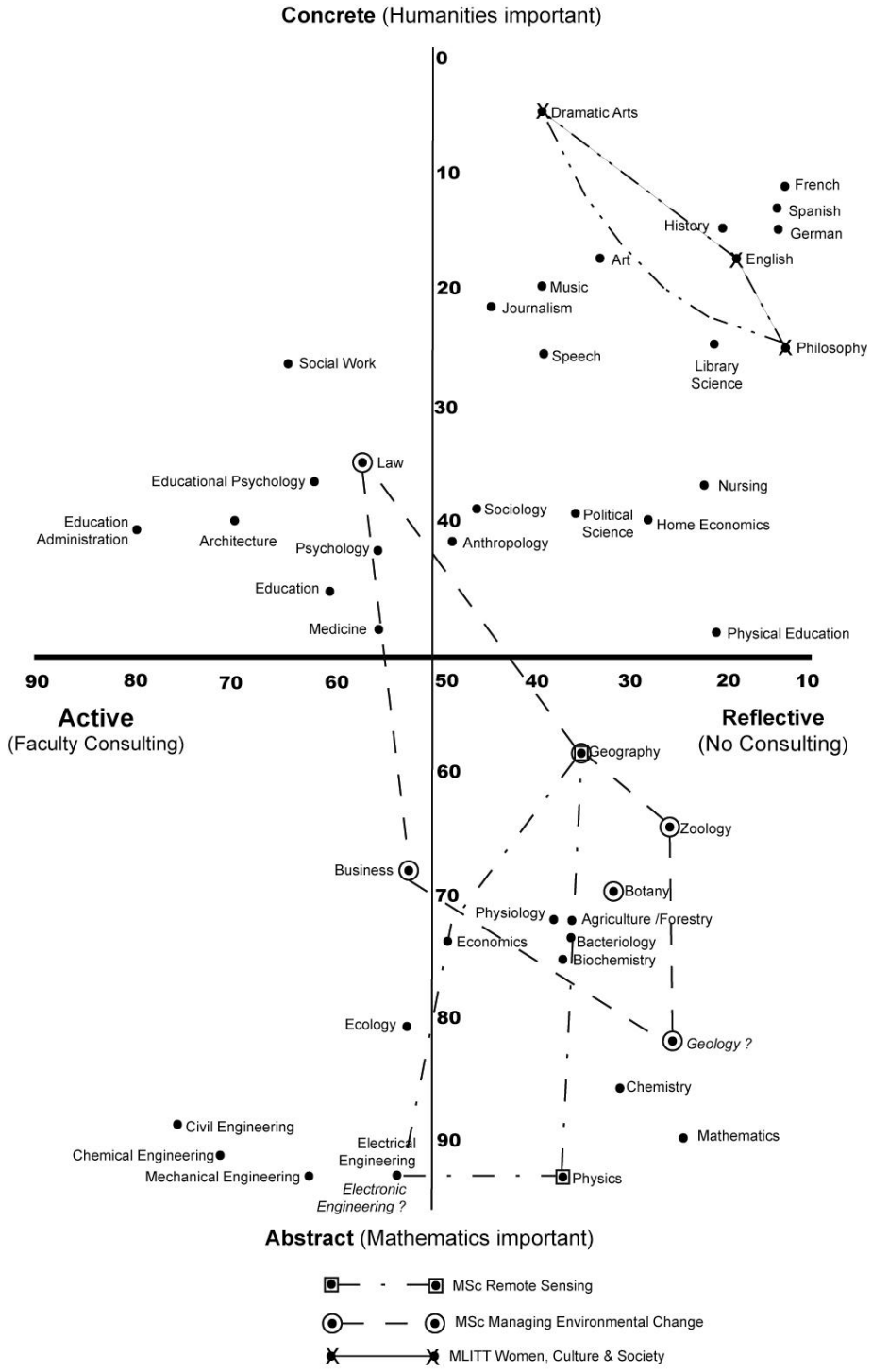
Course	*Disciplinary groupings*	*Type of course*	*Date course started (length of run)*
MSc in Tourism and Sustainable Development (UoG)	Environment, Tourism, Geography	Sustainable development (SD) core	5 years
MSc Environmental Policy and Management (UoG)	Environmental science, Policy, Business	Sustainable development (SD) core	15 years
MA Film and Media (UoG)	Film, Media, Audience studies	Applied with vocational element	5 years
MA Research Methods (UoG)	Range of discipline areas; [2] (Arts & Humanities, Countryside Planning, Earth Sciences, Education and Social Sciences, Human Geography and Sport and Leisure)	Research methods course	2 years

[2] The MA/MSc in Research methods is comprised of six named routes that provide generic and specific research methods training. All students regardless of route come together to take a compulsory interdisciplinary module *RR401 Introduction to Research.*

Course	*Disciplinary groupings*	*Type of course*	*Date course started (length of run)*
MSc Managing Environmental Change (Dundee ; run jointly with St Andrews University)	Biology, Environmental sciences, Law, Business, Geology, Geography	Course with a sustainable development focus	5 years
MSc Remote Sensing (Dundee)	Electronic engineering, Physics, Geography, Computing	Specialist skills course	20 years
MSc Globalisation: Origins, Development and Contemporary Impact (Dundee)	Economics, Politics, Business, History, English	Course with an academic/ research focus	5 years
MLitt Women, Culture and Society (Dundee)	English, Film History and Philosophy and the University's Archive and Visual Research Centre	Course with an academic/ research focus	5 years

Courses varied in the extent that the discipline mix was contiguous, for example when considered in relation to Kolb's learning style grid (see Figure 4).

Figure 4: Concrete/ Abstract and Active/ Reflective orientations of academic fields with the discipline mix of three PGT courses in this projected added (from Kolb 1984, p. 127)



Courses also differed in terms of their age and developmental history and how they sat relative to contributing departments. For example, the MSc *Remote Sensing* at Dundee was run across a number of departments and had been operative for 20 years. In contrast, the MSc *Managing Environmental Change* has run since 2002 and is delivered collaboratively between Dundee and St Andrew Universities. The MLitt. *Women, Culture and Society* developed out of an interdisciplinary staff research reading group.

6.1.2 Characteristics of the students surveyed

The characteristics of the students who responded are outlined in Tables 13a-c. A total of 32 students participated in the questionnaire survey. Twenty six students from the University of Gloucestershire and six from the University of Dundee responded to the survey. The following characteristics of the students were considered in the questionnaire survey:

- Current PGT course and whether it had a vocational focus;
- Age;
- Gender;
- Nationality and cultural background;
- Discipline area of previous academic study at undergraduate level;
- Country of previous academic study at undergraduate level;
- Vocational experience.

Nature of the PGT course studied: Participating students were studying a variety of postgraduate courses, although there was a clear emphasis on environmental subjects (a total of 16 students or 50% of the total), which included environmental policy and management, water and environmental management and climate change management. Five participants were taking the MSc in *Globalisation* at the University of Dundee.

Table 13a: Characteristics of the students: course selected

Category	*Detail*	*Frequency*	*%*
Environment/SD subjects	Environmental policy and management (9), water and environmental management (3), Environmental Impact Assessment and management (3) climate change management (1), managing environmental change (1).	16	50
Tourism/ SD	Tourism and urban culture (1), tourism and sustainable development (1)	2	6
MSc Globalisation (University of Dundee)		5	15
Art, Media, Women, Culture & Society	1 MA film and media, 1 MA by research in History of Art, 1 Women, culture and society.	3	9
Research Methods	MSc (1) and PGCert (1)	2	6
Unspecified	MPhil/PhD	4	12

Age: Participants' ages ranged from 21 to 57, but the majority were aged under 35 (22 students or 65% - see Table 13b).

Table 13b: Student character in the questionnaire survey: age distribution

	Number of students	*%*
18-24	10	31%
25-34	11	34%
35-44	5	15%
45-54	4	12%
55-64	1	3%
65+	0	

Gender: 17 participating students were male and 15 were female.

Disciplinary background: Participating students came from a wide range of undergraduate subject backgrounds. These ranged from social sciences (psychology, government and sociology, international studies) and environmental sciences (geography, marine geography, environmental science, environmental management) to natural sciences (chemistry, biological sciences). Other students had studied humanities (fine art/history of architecture, history, theology), sport and exercise sciences or more vocational subjects (design and production, tourism, management).

Previous work experience: 23 students gave detailed accounts of previous work experience, which varied in length (between 3 months and 37 years when specified) and was often related to their current postgraduate study.

Cultural background: 22 of the students were British, with the remainder having a diverse range of nationalities – American, Bangladeshi, Chinese, Gambian, Ghanaian, German, Indian and Irish. All students had carried out their previous undergraduate study in their home nation, with the exception of a Gambian student who had studied in Nigeria at undergraduate level.

Perceived nature of the postgraduate course: Ten students stated that their current postgraduate study was vocational, although interestingly this was not necessarily coherent within particular courses (for example one MSc Globalisation student felt that their course was vocational but four other students on the same course did not). Five of these students had also stated that their undergraduate study was vocational (see above). Students who felt that their postgraduate study was vocational tended to be studying environmental subjects with links to sustainable development. However, the majority of students (22 students, or 69%) did not feel that their current course was vocational. There were therefore interesting differences in perception between students on the same course concerning their course was 'vocational'.

Focus groups

Two focus groups were carried out at the University of Dundee and two at the University of Gloucestershire. Table 14 shows that the focus group participants from both institutions came from diverse cultural (British, Ghanaian, Indian, Nigerian) and undergraduate (Geography, Environmental Science, English Literature, Chemistry, Art, International Studies) backgrounds. The interdisciplinary postgraduate courses currently being studied by the focus group participants was varied, with some courses having an

Environment focus (Environmental Impact Assessment, Water & Impact Management), but others included Globalisation, Remote Sensing and History of Architecture.

Table 14: The composition of the student focus groups

Focus group	*Total participants*	*Current course*	*Cultural background*	*Undergraduate background*
Group 1, University of Dundee	3	MSc Remote Sensing	Nigerian	Geography
		MSc Remote Sensing	British	Environmental Science
		MSc Globalisation	Indian	English Literature
Group 2, University of Gloucestershire	4	MSc Environmental Impact Assessment and Management	British	Environmental Science
		Water & Environmental Management	Ghanaian	Chemistry
		MA by research (History of Architecture)	British	Joint Honours in Fine Art & History of Art
		PGDip Tourism & Sustainable Development	Irish	International Studies
Group 3, University of Dundee	2	Women, Culture and Society	British	English Literature
		Women, Culture and Society	Indian	English Literature
Group 4, University of Gloucestershire	4	Environmental Policy and Management	British;	Geography
		Environmental Policy and Management	Ghanaian	Chemistry
		MA by research (History of Architecture)	British	History
		MA by research	Libyan	Business Studies

6.1.3 Characteristics of staff surveyed

Four staff were surveyed from University of Gloucestershire. Two each taught on the MSc Environmental Policy and Management and the MA Research Methods where one was also a course leader. The three staff from the University of Dundee were the current course leaders for the MA Globalisation, MSc Remote Sensing and MLitt Women, Culture and Society. The length and depth of engagement with interdisciplinary teaching at postgraduate level varied from 3 to 15 years.

6.2 Student expectations of interdisciplinary learning

6.2.1 Defining the territory - understanding what interdisciplinarity means

In setting the scene to the project, there was initial confusion and uncertainty among some students over what the term 'interdisciplinarity' does or could mean. Student responses reaffirm the 'looseness' of definition with regard to interdisciplinarity by offering a range of differing descriptions: e.g. 'multi focused', 'mingling' (see Box 1).

Box 1: Students defining 'interdisciplinarity'

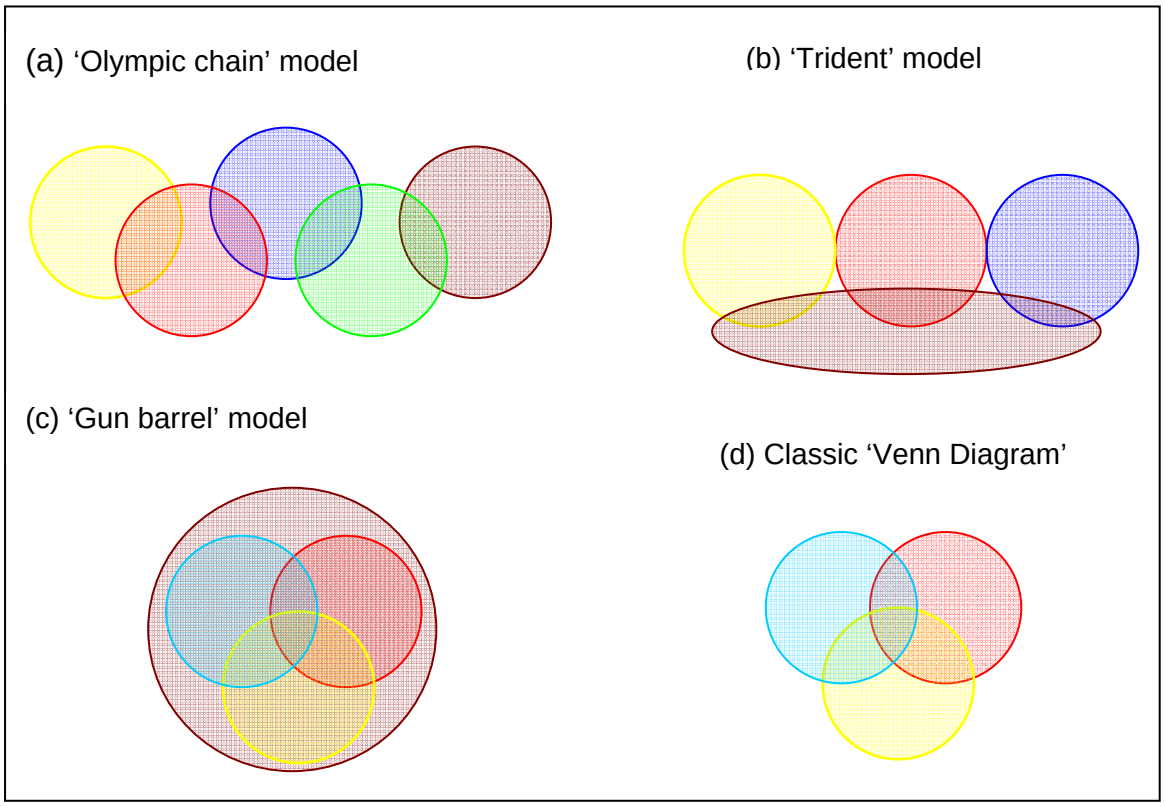
'I think maybe synergy is the word I am looking for to try and summarise what I mean. Interdisciplinary is a less familiar term. '

'I'm used to that from my degree and everything I've done. I see [interdisciplinarity] more as the more fusing together as opposed to knowing how to do lots of things but not necessarily there ever coming together as such.'

This was particularly evident in comparison to understandings of 'multidisciplinarity', revealed in student focus group discussions. There were also different expectations of what these different terms might mean specifically in context of the learning environment (cf. Hansson, 1999). Some students preferred to visualise their conceptions of interdisciplinarity with different models (Figure 5):

- the 'Olympic chain' model with interdisciplinary learning at the interfaces of a series of coupled disciplines;
- the 'trident' model where the disciplinary elements are learnt separately and then subsequently integrated,
- the 'gun barrel' model where different disciplines sit together but there is no interaction at the interstices (actually 'multidisciplinarity'); and
- the classic 'Venn diagram' type model where a number of disciplines are integrated be activity at the core.

Figure 5: Students' visualisations of their conceptions of 'interdisciplinarity'



For many students, the interdisciplinary nature of their course was not something that they had explicitly considered as an overt element of its character. Many commented more in terms of what their peers brought to the learning community and other elements of student diversity (e.g. cultural background) were considered more explicit elements. The one group that differed strongly were the students on the MLitt *Women, Culture and Society* who had a strong sense of their own interdisciplinarity of study and the interdisciplinarity of their course.

6.2.2 Previous learning experience and transitions to IDL

There were also contrasting understandings of interdisciplinarity in relation to the student's perceived previous academic background (Box 2). This included assessment of students' initial expectations of interdisciplinary learning.
Only 52% of students felt a strong association with only one relevant discipline in their past learning experience, however only 41% felt that there had been integration of learning between disciplines in their previous learning experience. 82% of students agreed or strongly agreed that they had a strong association with their main disciplinary home (Q1) and were confident in communicating with others from within their discipline (88%; Q6). The evidence from the student survey suggests that students do make the links between the knowledge and skills that they bring from either their disciplinary homes or previous interdisciplinary learning at undergraduate level. 79% and 76 % agreed that bridges were built between previous knowledge and skills respectively (Q2/Q3) although there was clearly potential for more attention to these bridges in some areas.

Box 2: The discipline-base of students' previous academic experiences

'I do not believe the interdisciplinary learning to be very explicitly explained - perhaps this is because my background is Geography, which is quite a diverse subject. Others with narrower backgrounds may be more aware of the interdisciplinary nature of the course.'

'Can't conceive of being anything other than interdisciplinary'

Table 15a Student expectations of IDL (a) Previous learning experience (% agree or disagree categories)

Statement	*% agree categories*	*% disagree categories*
My previous undergraduate course focused on a single relevant discipline.	52	39
I feel a strong academic association with my disciplinary background	82	3
I bring a well-defined body of knowledge from my disciplinary background	79	0
My disciplinary background uses specific or well acknowledged methods	76	6
There are well established modes of communication with others from my disciplinary background	55	15
I am confident in communicating with others within my disciplinary home	88	6
My previous undergraduate course allowed me to acquire knowledge in several disciplines but did not integrate them.	28	41
Individuals from my undergraduate discipline are able to work closely with individuals of other disciplines.	67	3
Interdisciplinary study was one of the factors that attracted me to my present course.	65	15

6.2.3 Learning styles in previous undergraduate degree

Students were asked about both about their preferred learning style in their undergraduate course and their perception of the learning style needed for interdisciplinary learning in their present taught postgraduate course. In the first instance, there was variable personal awareness in students of what 'learning style' actually meant:

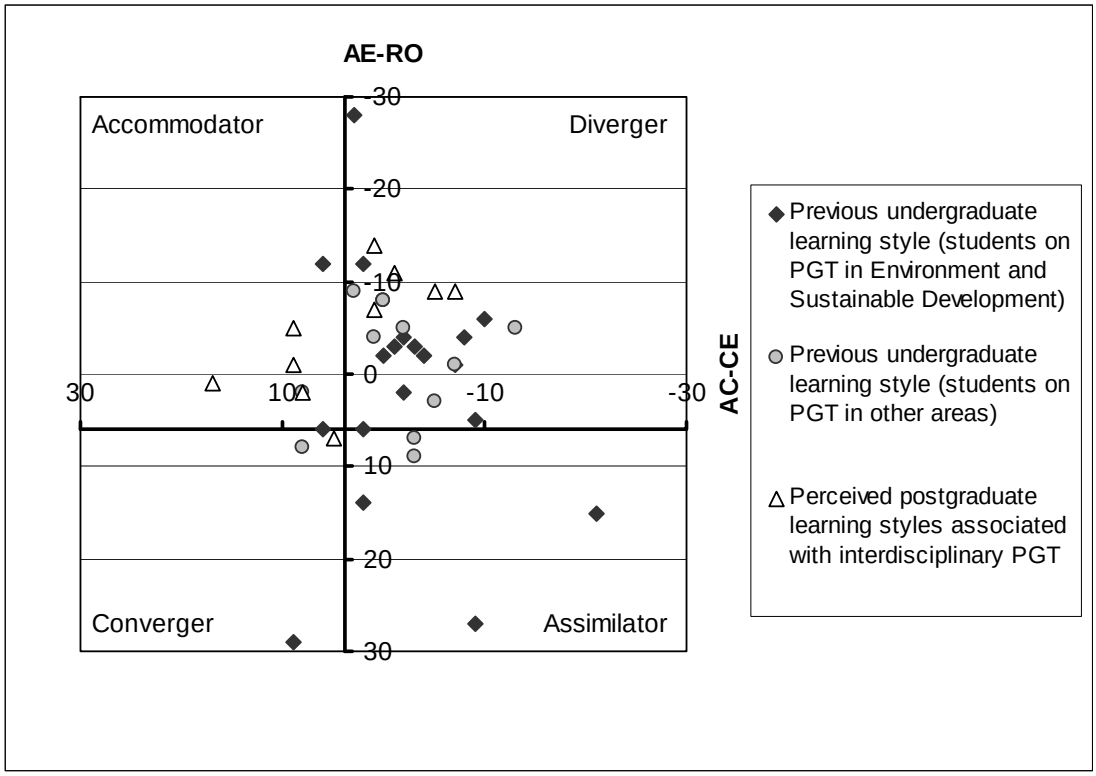
Box 3: Student perceptions of learning styles

'I don't understand the question. The notion that I am aware of any personal 'learning styles' is an educationist's fantasy. I just learn the way I learn!'

The learning style questions clearly were off-putting to some students as some questionnaire responses were uncompleted. However with a larger questionnaire

response, there would be potential for learning styles associated with different Master's level students (cf. undergraduates, Healey *et al.*, 2005) to be compared. This would allow tracking of the students' perceived shifts from different disciplinary backgrounds to interdisciplinary learning. It would therefore be possible to get some sense of the learning style 'journey' from personal disciplinary to personal interdisciplinary style.

Figure 6: Learning styles associated with previous disciplinary learning and IDL learning



Interdisciplinary learning styles might be expected to differ with the cluster of disciplines involved and where they sit on Kolb's plot of the orientations of academic fields along Concrete/ Abstract and Active/Reflective axes (Figure 3). The dominant learning styles were fairly consistent across the group of students surveyed, mainly sitting in the diverger/ accommodator categories (Figure 6). In the small survey here, the majority of students on SD courses were predominantly divergers and assimilators (53 and 47% respectively) but with a large amount of scatter. The outliers tend to represent the learning styles of individual international students. On the non-SD courses, there was less scatter with divergers as the dominant group (73%). A minority of students (9) attempted the question about their perceived learning style in IDL but most frequent responses were in the 'diverger' (4) and accommodator (3) categories.

Experience of the transitions to IDL

Experiences of the transition to interdisciplinary learning were varied (see Table 15b; Box 4a). Awareness of the interdisciplinary nature of their PGT study was only partial (65% responding positively) with other personal issues like 'personal lack of confidence in ability and intelligence' being mentioned more frequently. 42% students found encountering new knowledge and approaches to study in their interdisciplinary Master's course difficult while others spoke of the experience of enlightenment: 'everything came into context, everything made sense but in the initial stage everything was … is so

individual and unrelated it was quite difficult.' In terms of peer and staff recognition of previous capacity brought to the learning table, students felt that knowledge rather than skills/methods were prioritised (88 and 58% of 'agree' responses, respectively).

Box 4a: Student experiences of the transition to interdisciplinary learning

'Everything came into context, everything made sense but in the initial stage everything was … is so individual and unrelated it was quite difficult.'

'Then I suppose the barrier is if you've come from a single discipline or a very specific way of learning then you're playing catch up to some people….'

'I will describe these as a challenge rather than barriers. The diversity in the style of teaching and learning between my previous study and current postgraduate study was a real challenge for me. Another aspect worthy of mentioning is the complete change of programme of studies. I expected my postgraduate studies to be directly related to my undergraduate studies, but it rather introduced me to different disciplines altogether.'

'I found interdisciplinarity a logical progression, and feel that the first steps towards this were covered within my first degree.'

The transition to postgraduate study in general as opposed to interdisciplinary study in itself, brought challenges for some students (see Box 4a). For some international students, part of the challenge came from adapting to teaching and learning styles in a UK context as well as embarking on an interdisciplinary course of study:

Box 4b: Generic student experiences of the transition

'I don't know whether or not it's just coming from like into interdisciplinariness but coming from undergrad to postgrad I just never had so much work to do! '

'Lectures here are to guide you and point you where you should read. Back home, at least, they test you quite a lot more than here.'

Table 15b: Student experiences of interdisciplinary learning (b) Transition to present learning experience (% agree or disagree categories)

Statement	*% agree categories*	*% disagree categories*
Interdisciplinary study was one of the factors that attracted me to my present course.	65	15
The transition to interdisciplinary thinking was well supported by course materials.	65	8
The transition to interdisciplinary thinking was well supported by tutors.	69	12
The learning experience has encouraged me to build bridges between my previous and current bodies of knowledge in a meaningful way	73	4

Statement	*% agree categories*	*% disagree categories*
The learning experience has encouraged me to integrate methods and approaches between my previous and current academic experiences.	81	0
Prior knowledge from my previous disciplinary background is recognised by students and tutors and gave me confidence in my studies.	88	0
Prior methodological expertise from my previous disciplinary background is recognised by students and tutors and gave me confidence in my studies	58	12
I found encountering new knowledge and approaches to study in my interdisciplinary Masters programme difficult.	42	27

6.3 How postgraduate students in interdisciplinary Masters' courses perceive the teaching-learning environment

When asked about general perceptions of their Master's course (Table 15c), only 54% students perceived that they recognised the benefits of interdisciplinary learning at the start of their course. Just 38% students thought that disciplinary learning was jeopardised by disciplinary prejudice but may still cause problems in certain settings. 63% of students felt that it was clear what they were supposed to learn in an interdisciplinary learning context while 67% of students felt that they had been given choice about how they went about learning. 92% of students felt that working with students from varied disciplinary backgrounds is a valuable experience. 71% students felt that their past disciplinary background provides enriching context to my interdisciplinary study

Table 15c Student experiences of IDL (c) general perceptions of teaching and learning environment (% agree or disagree)

Statement	*% agree categories*	*% disagree categories*
From the beginning, the benefits of interdisciplinary study were clear to me.	54	25
I became more confident about interdisciplinary study as the course progressed.	83	4
Being part of an interdisciplinary learning environment is a major strength of this programme of study.	79	0
My current postgraduate course allows me to integrate knowledge from several disciplines around a central theme.	92	0
An interdisciplinary learning environment brings opportunities that monodisciplinary approaches to learning does not have.	78	0
Interdisciplinary learning is threatened by disciplinary prejudice.	38	21
Working with students from varied disciplinary backgrounds is a valuable experience.	92	8

It was clear to me what I was supposed to learn in an interdisciplinary learning context	63	13
We were given a good deal of choice over how we went about learning.	67	17
My past disciplinary background provides enriching context to my interdisciplinary study	71	0

6.3.1 SWOT analysis of IDL

Students were initially asked in open questions to provide an assessment of the strengths, weaknesses, opportunities and threats (SWOT analysis) associated with learning experiences in an interdisciplinary environment. This yielded a variety of observations that focus on different aspects of learning including: modes of delivery, how learning communities operate learning outcomes, employability, resourcing etc.

6.3.2 Strengths

The students' perceived strengths of interdisciplinary learning fell into the following categories:

- *Distinctive learning outcomes*. These included: holistic thinking; ability to synthesise/integrate ideas from different disciplines; to make unique connections between different schools of thought; to gain knowledge of several different perspectives in order to gain a better understanding of the 'whole' or the 'wider picture' of a subject area or problem focus

Box 5a: Perceived strengths of interdisciplinary learning in PGT: Learning outcomes

'It makes you think outside of the box and look at the wider picture. You don't become single minded.'

'Learning to make new connections between apparently disparate ideas.'

'You get to learn about a range of approaches to the subject. One person may have a different approach to another and it was interesting to learn this'

- *Learning environment*. Interaction with/ working with other students and tutors with a diverse range of backgrounds and experiences; exposure to a variety of perspectives.

Box 5b: Perceived strengths of interdisciplinary learning in PGT: Learning community

'Discussions were wide and varied, with a variety of perspectives with the differing backgrounds fellow students came from'

'Learning to work with different backgrounds is very important vocationally as future employment is likely to involve teams with different focuses, which have to work together for a common goal'

'New areas of ideas and communication opening that were not noticed before'

'So between us we did have four times as much knowledge with an overlap, rather than one set of knowledge almost coming from the same company, or the same city, or the same discipline, so yes it was quite useful just in terms of conversation and for course work as well.'

- *Employability*: Learning to work with people from diverse backgrounds/disciplines as a valuable skill for the workplace; vocational nature of skills.

Box 5c: Perceived strengths of interdisciplinary learning in PGT: Employability

'Learning to work with different backgrounds is very important vocationally as future employment is likely to involve teams with different focuses, which have to work together for a common goal'

'It is important to be interdisciplinary within the environmental sector'

6.3.3 Weaknesses

Students' perceived weaknesses of interdisciplinary learning dealt with a range of issues:

- *Assumed levels of prior knowledge* (see Box 6a) Confusion about interdisciplinary learning at the start of the course; the presence and expected use of prior knowledge was an issue for several students, both for those who felt they did and did not have it. Knowledge may be inaccurately assumed or covering familiar ground for the benefit of others may be tedious.

Box 6a: Perceived weaknesses associated with interdisciplinary learning: prior knowledge

'For people with very little background knowledge to the topics there was a lot of covering of the basics beforehand, which appeared wasted time to those with more previous knowledge.'

'Where you have a group of people from different educational backgrounds […] prior knowledge of a topic will effect how much you get out of an individual lecture that only selectively teaches you about that topic'

- *Ability to engage across discipline boundaries (language etc.*; see Box 6b) The need to cross over to different/unfamiliar subjects was also raised as a weakness

of interdisciplinary learning. This particularly applied to the move from non-scientific to scientific subjects/methods for those students from a non-scientific background. There were also associated issues of 'understanding the language'. Some students indicated concerns about an inability to adapt to scientific perspectives. Further issues associated with the breadth and depth of study were also raised.

Box 6b: Perceived weaknesses associated with interdisciplinary learning: adaptation and ease of transition

Ability to adapt to interdisciplinary learning

'Some people do not adapt to such an environment. Those with a background and desire to work with human geography may have difficulty adapting to the more scientific parts of the course, whereas it seems easier the other way round.'

Ability to engage across discipline boundaries (language etc.)

'The information may be too technical for you to understand or too science based.'

'You can sometimes question your own chosen methodologies when talking to others from other disciplines which can sometimes put doubt in your mind'

'There is often a lot of topics to cover in short space of time and this often leads to topics being quickly brushed over without actually learning that much, often only having one lecture on a specific topic but having to absorb several topics in one day, this is too much.'

'Sometimes it's hard to decide what's relevant in some modules you were expected to focus on certain areas'

'Waters down the depth of the study and appropriateness'

- *Generic knowledge versus specialist knowledge*. Perception that the wide breadth of the interdisciplinary material covered means that subject depth is 'watered down'.

- *Increased ownership of learning* was mentioned by one student. 'Students may need to take more ownership of their learning than is strictly good for them'.

- *Negative perceptions of disciplinary resource boundaries. One student mentioned 'people* being defensive of their own resources (equipment, materials, etc.)'.

6.3.4 Opportunities

Responses around opportunities fell into four main categories: learning outcomes particularly ways of thinking (holistically; analytically), research and communication skills; learning communities and skills for employability.

- *Learning outcomes*. Some students identified the opportunity to get a more complete view of the subject area and several students indicated that the interdisciplinary learning environment had given them the opportunity to develop and broaden their learning; IDL 'opens the mind' in a significant way. Others concurred with Brewer's view that interdisciplinarity involves 'engaging and exploring the gaps in order to construct 'a kind of metaknowledge' (1999, p. 379).

Box 7a: Perceived opportunities through interdisciplinary learning: Learning outcomes

Holistic thinking

'Gives a better all round picture of the central theme of the subject rather than just approaching it from one angle'

'The option for synergies to arise and it is ultimately more satisfying to understand large scale systems'

'That is the main thing I think. Not considering just one aspect of the problem but seeing so many aspects of the problem.'

Analytical thinking

'I thought I was fantastically analytical until I started really doing this and then I realised that I was fairly superficial in my analytical approach, there was something more to it and I think the fact that interdisciplinary makes you step outside your own discipline just to see the commonalities amongst disciplines.'

Research skills:

'it's great because you've got a whole range of skills rather than just one set of skills. That's the main positive, the main reason for doing it really.'

- *Communication skills* Student responses reinforce the fact that 'cooperation' is an essential component of 'communication at the interfaces of the disciplines...' (Hansson, 1999, 341).

Box 7b: Perceived opportunities through interdisciplinary learning: Communication skills

'You are able to talk to various other departments at least and also convey to them what you're trying to talk about and what you mean.'

'You are able to relate to a wider audience than just your own speciality.'

'New areas of ideas and communication opening that were not noticed before'

'I think it's also very good because when you .. you are able to look at problems and able to bring together maybe different people and get the best out of them and at least be able to communicate to a wider audience. I think even like when the project you are going to part of you find yourself an integral part of it because you'll be able to communicate with a wider audience.

The results for learning outcomes compare interestingly to a previous study of the learning experiences of mature students (Toynton, 2005) after the introduction of interdisciplinarity on their undergraduate course, which found that learners valued the acquisition of transferable skills. Also, the valuing of their prior knowledge gave them confidence and provided a more central role in the learning experience.

Learning communities. For several students, interdisciplinary learning presented a potentially unique opportunity to work with and learn from others from different disciplines. Related to this point, one student identified the opportunity to make new friends and contacts from the course.

Box 7c: Perceived opportunities through interdisciplinary learning: Learning communities

'Working with people one would otherwise not have the opportunity to work with'

'You definitely learn from one another, it was not about just listening to a tutor'

'Opportunity to develop and broaden your level of previous knowledge or experience abounds.'

- *Employability* There was perceived opportunity to link interdisciplinary learning to skills needed in the workplace. Brewer's view that: 'the combination of disciplines adds value …' (1999, p. 328) found resonance amongst the student responses. .Box 7d provides an indicative quotation.

Box 7d: Perceived opportunities through interdisciplinary learning: Employability

'In gaining skills from others, this will be of use in the workplace when you will be surrounded by people of different backgrounds that you must engage with.'

- *Autonomy in learning*. One student mentioned 'learning to become more independent' as an opportunity associated with IDL.

6.3.5 Threats

The perceived threats to interdisciplinary learning fell into four themes:

- *Wide breadth of subject coverage and lack of specialisation* in interdisciplinary learning was seen as a potential threat for one student. (related to perceived lack of depth of study). Linked to this point, the wide range of material covered was critiqued by another student who identified 'trying to fit too much into each module and missing out on the core principles that the module is try[ing] to teach' as a threat to learning. There was a perceived temptation to include too much material. Other students again identified issues surrounding subject crossover as a threat, including the perceived mutual exclusivity of (natural) science and non-scientific subjects. Others highlighted concerns about the ability to acquire specialist disciplinary knowledge and skills in parallel to IDL.

- *Disciplinary perspectives/ prejudices* Students comment on the inaccessibility of concepts and perceptions of the relative value of disciplinary opinions or stances (Box 8a).

Box 8a: Perceived threats to interdisciplinary learning

'It may be difficult to develop expertise in a single discipline as efforts are always made to develop some skills or level of knowledge in other programme themes'

'What you learn may be quite general when you look at all different view points.'

'Sometimes other researchers from other backgrounds do not understand the concepts of research in your particular field/discipline.'

Disciplinary bias evident in responses

'Science is replaced with unsubstantiated opinion.'

Two students raised confusion (possibly linked to the wide range of material?) as a threat to learning in an interdisciplinary environment, which can be demotivating.

'Can leave students confused because of the shear amount of material that is thrown at them from different disciplinary perspectives.'

- *Employability* Issues raised included not having the detailed knowledge, potentially desired by employers. Concerns were raised about possible employer perspectives of (and appreciation of the benefits of) interdisciplinary courses and how this might impact on related employment prospects. Perceived lack of specialization may also affect employment prospects.

Box 8b: Student perceptions – IDL and threats to employability

'Some employers don't see the benefits of learning in this style.'

Employer culture towards having experience in primarily one discipline.

- *Learning communities* The failure to maximize the co-learning opportunities presented by interdisciplinary learning was seen as a potential threat (see Box 8c).

Box 8c: Student perceptions – IDL and threats to co-learning

'Not getting the most out of having people with different disciplines working together'.

'Sometimes other researchers from other backgrounds do not understand the concepts of research in your particular field/discipline'.

- *Crossover between science and social science/ humanities.* Students highlighted potential for confusion in understanding key concepts and how different disciplinary knowledge and skills are perceived and valued.

Box 8d: Student perceptions – IDL and threats to co-learning

'Science is replaced with unsubstantiated opinion.'

'Not understanding concepts from unfamiliar disciplines/ perceived incompatibility of scientific and non-scientific subjects.'

'Undervaluing the discipline people know less about, particularly undervaluing the so called "soft skills" associated with social sciences.'

'Sometimes other researchers from other backgrounds do not understand the concepts of research in your particular field/discipline.'

- *Institutional organizational structures and cultures* as a potential threat: 'Lack of ownership on the part of faculty'.

The negative aspects of their learning experience focussed on the challenge to their expectations: 'not only could they not be passive learners, neither could they remain within the preconceived boundaries of their defined areas of interest' (Toynton, 2005 p. 114).

6.4 How postgraduate students approach learning and studying in an interdisciplinary context

6.4.1 Perceptions of co-learning environments for staff and students

The summary results of the questionnaire survey are shown in Table 15d. Interdisciplinary learning was thought by both students and tutors to offer excellent opportunities for co-learning but with some caveats. For example, 95% of respondents thought that students' views from different discipline backgrounds were valued on their course but only 64% students felt that there were plenty of opportunities for student co-learning at postgraduate level in an interdisciplinary context. 77% of students thought that staff were important role models in interdisciplinary learning. Only 59% students felt that staff helped them to see how you are supposed to think and reach

conclusions in interdisciplinary learning. However 86% of students felt that talking with staff from different discipline backgrounds has helped me to develop my understanding.

Table 15d: Student experiences of IDL (d) co-learning communities (% agree and disagree categories)

Statement	*% agree categories*	*% disagree categories*
I am receptive to ideas from other students bringing other disciplinary knowledge and approaches in the class.	95	0
I am skilful in interdisciplinary teamwork	73	0
I am comfortable with organising and participating in interdisciplinary projects	73	5
I believe that interdisciplinary team efforts are important to achieving effective interdisciplinary learning	81	0
I value co-learning with students from different discipline backgrounds	91	0
Students' views from different discipline backgrounds were valued in this course	95	0
There were plenty of opportunities for student co-learning at postgraduate level in an interdisciplinary context	64	14
Talking with other students from different discipline backgrounds has helped me to develop my understanding.	82	5
Students from different disciplinary backgrounds supported each other and tried to give help when it was needed.	77	0
Staff were important role models in interdisciplinary learning.	77	5
Staff helped us to see how you are supposed to think and reach conclusions in interdisciplinary learning.	59	9
Talking with staff from different discipline backgrounds has helped me to develop my understanding.	86	5

Several key themes were identified in the more focused discussions around interdisciplinary co-learning environments. These included what different students brought to the table as well as issues of language and communication (and associated development of these skills):

Language of the interdisciplinary learning community. The notion of needing to communicate in different language has parallels to inter-cultural communications.

Box 9a: Experience of teaching and learning: issues of language

'It was like learning a different language, a language that was in a different alphabet like Japanese or something. It was really tough because it is an entirely brand new way of describing an environment, or a world almost. So yeah, even with repetition and repetition you have to keep doing it and keep doing it and keep doing it otherwise …'
'Yes it was about language which had so many rules and exceptions. It was like learning English for the first time.'

- *Communication and cooperation within communities* Students noted the importance of 'cooperation' as an essential component of 'communication at the interfaces of the disciplines...' (Hansson, 1999, 341). They also commented on the key role of tutors in interdisciplinary learning.

Box 9b: Learning outcomes from interdisciplinary learning: communication and cooperation

'You are able to talk to various other departments at least and also convey to them what you're trying to talk about and what you mean.'

'I think it's also very good because when you .. you are able to look at problems and able to bring together maybe different people and get the best out of them and at least be able to communicate to a wider audience.'

Role of staff/ tutor in interdisciplinary learning

There is clearly a difference between students' perception of whether staff helped them 'to think and reach interdisciplinary conclusions' (59%) and their perception of whether talking to staff helped them develop interdisciplinary understanding (86%). This suggests that the staff-student engagement occurred outside of class time and that students want to be told explicitly in class 'how to think in an interdisciplinary way'. Students also acknowledged the challenges for staff in trying to deliver interdisciplinary teaching and learning. Tutors' comments reflect the uncertainties for some staff in facilitating learning outside their 'comfort zone.

The tutor has a crucial as role model/exemplar in interdisciplinary learning with the role of course leader of particular significance. If as Karlqvist (1999, p. 379) states: 'Interdisciplines literally means 'between disciplines,' i.e., between the bodies of knowledge defined by the theories and methods of established disciplines, then the student responses in Box 9c would suggest also that team teaching is a particularly useful device to foster learning that engages in the gaps between disciplines.

Box 9c: Student and tutor perceptions of tutor roles and involvement in IDL

Student responses:

'It almost seems to me a lot of staff are quite confused about what they're trying to do.'

'The reason we were doing it didn't appear to be immediately obvious to the person who was delivering the lecture, or quite how it fitted into the rest of the programme.'

'Ours was remarkable for the fact that we were introduced to some tutors who came from, in our case sociology and the other case philosophy who kind of gave you a different geometry of how research might work so it was like a breath of fresh air every time, something new happened all the time and it was very free wheeling,'

'The courses I've done and enjoyed the most have been those which have had a single person almost directing it and been constantly there even when there are guests so that

they can bring in the contextualisation of it. The ones where I've struggled are the ones where someone comes in to talk about forest policy and the next person talks about soil policy.'

'He [course leader] is a good example of multi-discipline or inter-disciplinarian in that he knows a fair bit about chemistry and physics and biology, mathematics and the whole gamut of science rather than just being a geographer or a geographer physicist. He's a very good example of somebody who knows a lot about everything rather than a bit about everything.'

'I think it's almost more difficult for the academic structure to deliver an interdisciplinary course because people come from their specialisations and they have a specialisation which they teach, which they lecture to, and they tend to deliver that and then the integration happens within the student or within the group of students.'

'Most staff engage very well. Problems can arise, however, if staff feel threatened or insecure when working beyond their normal sphere of expertise.'

'How little I understand about other areas of study.'

6.5 Learning design for interdisciplinary learning

6.5.1 Curriculum design for IDL

Tutors were asked about relationship between student diversity, interdisciplinarity and course design: Chicken or Egg? Tutor perspectives suggest that the relationship between interdisciplinarity and student diversity is part of the mix, informing and re-informing initial course design and development e.g.: 'Leading iteratively to increases in interdisciplinarity. A virtuous circle!' The most overt learning design for interdisciplinarity came in the MLitt *Women, Culture and Society*.

Part of the 'cross fertilization' highlighted by student responses related to both teaching styles and learning styles/ interdisciplinary learning outcomes and suggested an organic rather than a directed process. Tutor responses broadly confirmed the student perceptions and highlighted the IDL opportunities provided by an IBL? approach, e.g. to environmental issues or globalisation. However, as Hansson (1999) suggests, although interdisciplinarity might 'evoke many kinds of promises' (p. 339), the outcome is always indeterminate. As he states, 'Cross fertilization is a much more uncertain business' (p. 341).

Box 10a: Perceptions of curriculum design for IDL

Student perceptions

'At the time you think this is just for fun. I think that was quite interesting and quite revealing that they, the tutors, could think of the world in that way. That they could see links that perhaps we couldn't. So you're learning how to see things on a bigger scale I think.'

'It's more a case that you learn the individual things and then you stitch them all together. You don't realise but you have stitched them all together by the end of it.'

Tutor perceptions

'Generally, a broader understanding of research and sensitivity to complex issues and multiple perspectives. Ability to integrate methods productive.'

'It is difficult to be specific here as it will depend on the courses. But the skill set will be broader in all circumstances.'

'Obviously different bits of research 'craft' – one is hardly likely to be skilled at interviewing if one is a natural scientist.'

One student raised the lack of practical applications as an issue:

'Also there was often little actual indication of how some of the themes we learnt about were actually applied in the real world or how we would implement what we were taught in practice.'

Another argued that more group work would have developed this strength further:

'[It] would have been better if we had been involved in more group work allowing us to actually work with people from different disciplines in a team rather than just learning alongside them as individual students.'

6.5.2 Subject settings for interdisciplinary learning

Students were asked about what types of modules/units benefit most from learning with students from different disciplinary backgrounds and why? They provided the following suggestions:

- 'Large' or global environmental topics;
- research methods modules;
- epistemology, theoretical perspectives and methodology;
- practical modules;
- sustainability;
- modules based around communication and the development of communication skills.

Box 10b: Students' perceptions of useful settings for interdisciplinary learning

(a) *'Large' or global environmental topics*

'Modules that require different perspectives to large environmental topics, when discussing climate change a variety of perspectives were presented.
Any that involve some sort of consultancy work, as this is an area where different points of view must be considered and having a range of disciplines helps to cover all potential considerations'.

(*b) Subjects where people are likely to have a lay opinion*

'Politics based modules, for example, allow everyone to have an opinion and contribute to the discussion even if person has not studied a politics based module in the past.'

(c) Theoretical modules

'Theory/seminar modules would benefit because we could each see how our own area applied and learn about the others at the same time. Opportunity for connections to be made.'

(d) Practical modules

'Practical modules would as well, because, especially in film and media, you need multiple people of differing strengths and skills..'

(e) *Sustainability*

'Sustainability as sustainability encompasses many areas and it is good to gain a broad overview of many areas. The module 'Environmental Science for Managers'

'Some students were from science backgrounds and some were not. Everybody helped each other to understand.'

'Modules based on Sustainability, environmental protection, policy and management. Because you need to have the perspectives of all stakeholders to make an informed decision'.

(f) Modules that integrate science and policy

'I may say modules that usually integrate science and policy issues. A module like 'Environmental Science for Managers', for example, serves to elicit the interests and potentials of non-policy based students (i.e. those with purely science backgrounds) to appraise some policy issues by drawing experiences from colleagues with policy backgrounds. Thus the science-policy interplay becomes apparent in such a module. In my particular course they seem to work well - combining a science background to an issue with policy for how to deal with it.'

(g) *Research methods training*

'An 'Introduction to Research Methods' module was excellent and also the 'Qualitative Research Methods' module. They both provided the opportunity to learn about a variety of different methods and methodologies whilst getting an input from a range of students from different fields.'

(h) *All modules!*

'I think all modules or units - you just need to be open to ideas, possibilities etc.'

'All - a student from a different discipline may have detailed specific knowledge that is useful and if they don't then the need to explain and educate them is a useful exercise for both parties'.

'Most students can help teach each other from our personal strengths'.

Some students commented about modules with specific approaches to group learning include seminars, in order that all students can voice their opinions and have discussions together. Working in groups was also felt to be beneficial to students from different backgrounds and staff concurred with this view. The potential of field-based team teaching in IDL was also noted. In addition, tutors frequently need to be present anyway for health and safety reasons. Others commented on settings for interdisciplinary learning and that frequently interdisciplinary work took place in disciplinary space.

6.5.3 Interdisciplinarity and teaching methods

For tutors, interdisciplinarity was regarded as being overt in teaching methods and learning outcomes. However, apart from one student participant outlining the crucial role of presentations in the Research Methods programme, the focus group participants did not comment on any other learning activities. For the student participants, the interdisciplinary learning experience interacted with, and responded to, individual learning styles but more importantly with the diversity of the student cohort.

Box 10c: Interaction between interdisciplinarity of the student cohort and interdisciplinary learning

'So everybody came in very handy and it was a small class and so we could really sit down and discuss ideas and if you wanted help you could easily get together'.

'Between us we did have four times as much knowledge with an overlap, rather than one set of knowledge almost coming from the same company, or the same city, or the same discipline, so yeah it was quite useful just in terms of conversation and for course work as well. We all knew something slightly different so yeah I think it was a good thing.'

6.5.4 Learning outcomes and IDL

Students' perceptions of learning outcomes in interdisciplinary learning courses (in terms of quantity and quality of what they learn) were more restricted than those outlined in Table 6 (Ivanitskaya *et al.*, 2002).

Table 15e: Student experiences of IDL (e) perceptions of learning outcomes (% agree or disagree categories)

Statement	*% agree categories*	*% disagree categories*
I can communicate knowledge and ideas effectively in an interdisciplinary context to students of different disciplinary	94	0

backgrounds		
Interdisciplinary learning has enabled me to engage holistically with problems.	81	0
I have a better understanding of the strengths and limitations of disciplines.	50	6
I have developed the ability to establish connections between similar dissimilar contexts	69	0
I have developed the ability to tolerate ambiguity or paradox	69	0
I developed a capacity to perceive a balance between subjective and objective thinking.	81	6
I am able to communicate knowledge and ideas effectively across disciplinary boundaries.	75	0
I believe that participation in interdisciplinary learning will strengthen my ability for future professional practice	88**	13**
I can conduct effective problem-solving using the knowledge and skills of students/ peers from different discipline backgrounds.	88	0
I am able to apply an interdisciplinary knowledge structure to new interdisciplinary problems or themes	69	0
I am competent in organising and being responsible for my own interdisciplinary learning.	94	0

** both these values are rounded up from 0.5

The identified learning outcomes are listed below.

- developing new ways of thinking, particularly 'thinking holistically':
- making connections and the ability to integrate information;
- insight into a range of different research methods;
- problem-solving skills;
- organisational skills;
- skills in communication beyond the discipline.

Very few students mentioned assessment in an IDL context and how this might be designed to maximise the prescribed and serendipitous learning outcomes (cf. Field and Stowe, 2002). Dominant suggestions for types of assessment provide the best opportunities for interdisciplinary learning included assignment modes; group assignments, portfolio, webCT discussions; research based essays, report writing and project work. Here the emphasis was on formative assessment involving interactions with students and lecturers in the assessment process. The example assessments provided included those that required the student to draw on at least three methodologies or disciplinary perspectives in the investigation of a particular problem. Students perceived sharing of methodological approaches is perceived as a key element of IDL.

The actual process of assessment can be an important learning process for tutors, particularly in their role in setting and marking. Again these can have both formal and informal elements.

6.5.5 Interdisciplinary learning and employability

Students had a strong view or aspiration that skills learnt from interdisciplinary study would equip them for employment in the modern work context, with flexibility and multitasking mentioned as key skills. Only 52% of students felt that the vocational elements of their course provided good opportunities for interdisciplinary learning. 64% of students perceived that their experiences of workplace learning make them more receptive to interdisciplinary approaches to learning. One student also mentioned employer liaison: 'Could be further liaison with employers to match the course to their requirements'.

Box 10d: Perceptions on the interaction between interdisciplinarity and employability

'You should be flexible, be able to multi task and do more than one thing at a time.'

'The holistic idea, that it makes you a better worker and probably a better person as well just being able to see everyone's point, or all points in a rational, rounded opinion of something rather than just seeing one side of it or not knowing that there was another side to it because they hadn't looked for it. So yeah I would say the holistic part of it is a very good thing.'

'I hope that the interdisciplinary nature of future jobs will lend itself to a broad background of skills.'

6.6. ESD and interdisciplinary learning

The discussions around ESD and IDL focused on a number of themes. When separating the SD and other Master's provision in the outcomes of the questionnaire survey, it was difficult to pick out clear trends.

- *Learning outcomes*: There was a strong sense that to study ESD without an IDL approach to learning would lead to a reduction in important learning outcomes. Staff felt that learning outcomes from ESD and IDL were more appropriate for M-level engagement. Holistic thinking was most commonly mentioned and considered primarily developed through IDL. All SD students agreed that they could conduct effective problem-solving using the knowledge and skills of students/ peers from different discipline backgrounds. They all agreed that their current postgraduate course allowed them to integrate knowledge from several disciplines around a central theme.

- *Co-learning communities*: When considering whether students' views from different discipline backgrounds were valued in this course, all SD students were in the 'agree' categories. The role of staff as integrator is important for ESD (cf. Dawes et al.). 14% of SD students felt that could be more opportunities for student co-learning.

7. Discussion

The current study aimed to evaluate critically the learning experiences of taught postgraduate students on interdisciplinary Masters' courses. This discussion provides a brief synthesis of issues explored by theme.

- Defining interdisciplinary learning at PGT level
- Nature of the PGT course and IDL (including the interaction of different discipline areas in interdisciplinary courses and the role of 'vocationality' as a unifying element in interdisciplinary course delivery; the relative balance of theory and practice in interdisciplinary teaching)
- Experiences of interdisciplinary learning
- Transitions to Interdisciplinary learning
- Learning design for IDL and co-learning communities
- Learning outcomes associated with IDL
- Interdisciplinary and different types of learning style
- IDL and 'skills for employability'
- IDL and ESD

7.1 Defining interdisciplinary learning at PGT level

There are important questions as to whether or not IDL at taught postgraduate level is distinctive from that experienced in undergraduate learning or by research students. This is particularly so given the applied and vocational nature of many PGT courses that lend themselves to IDL, with 'management' as one aspect of interdisciplinarity. At PGT level, interdisciplinary learning comes from the integration of inputs from students, staff, work-place links as well as the focus of the subject area. PGT student cohorts are becoming increasingly diverse at entry, with work-based learners, international students, recent UK undergraduates and UK returners to learning frequently in the same class. Discipline base of prior academic study is frequently only one facet of the diversity of a student cohort and the specific character of that diversity can vary between different cohorts, with the serendipitous patterns of recruitment. Issues of cultural communication, preferred learning styles and learning approaches experienced in previous Higher Educational Institutions layer on disciplinary differences and other elements of student diversity (vocational experience, personal characteristics etc.).

Prior vocational experience can act as applied IDL and can be very diverse in its character and the skill development involved. In many cases, for the students, different international/intercultural experiences and contributions are a more overt element of diversity within the class. This provides both opportunities and challenges. When staff set up effective IDL environments, it is important to be aware of the existing knowledge, understanding, abilities, motivations and conceptions/ learning styles that students bring from their disciplinary backgrounds and elsewhere. Interdisciplinary learning at PGT level in the courses considered here varies significantly in the extent to which it is explicit and planned and the extent to which students are aware of the reality and potential of this approach to learning at the outset, during and by the end of their PGT courses.

7.2 Nature of the PGT course and IDL

There is a wide variety of interdisciplinary courses including problem-based and skills focused provision. Courses considered varied in the nature and history of their development and the extent that they are driven by markets or by the interdisciplinary research enthusiasms of staff. There may be less opportunity for the latter kind of PGT provision in the post-1992 University sector. The courses also varied in their discipline mix. Some combined contiguous and non-contiguous disciplines while in others non-contiguous interdisciplinarity dominated.

The student experience of IDL can vary based mainly on how the course is conceptualised and promoted to students by staff through the different phases of engagement including recruitment and delivery. Also important is whether the interdisciplinarity is developed through all possible avenues and whether vocationality or application is a unifying element in course delivery. These include:

- the subject focus of the course;
- the balance between theoretical and practical elements (both having potential for IDL but in different ways);
- how the course is structured (whether the course maximises IDL over multi-disciplinary learning elements; the extent to which IDL is promoted at the start of, and through, the course or whether the interdisciplinary element only manifests itself at the end);
- the character and development of the IDL community (students and staff);
- the staffing strategy (whether individual or team); and
- the approach of the staff as learning facilitators (whether staff teach individual blocks or whether there is a strong sense of team and team teaching).

Courses in this study tended to deliver on some but not all of the potential areas that integrate to provide an environment for effective IDL. Our evidence suggests that both more academic 'subject extension' courses and those that combine academic and vocational outcomes can benefit from IDL with more engaged and empowered student learning.

7.3 Experiences of interdisciplinary learning

Students' experiences of IDL were generally difficult to unpick from other areas of the student learning experience as there are many new elements for most students, including the steep gradient of the PGT learning curve. Students were able to articulate strengths, weaknesses, opportunities and threats to IDL and were generally positive about the experience when it was discussed with them. Key facets considered were the experience of the transition to IDL (Section 7. 4); the design of courses and how this acted to facilitate or act against IDL opportunities, the positive experiences and opportunities for co-learning (see Section 7.5) and the varied nature of learning outcomes (see Section 7.6).

A main challenge to the IDL experience focused on understanding what IDL actually comprised and on acquiring the language needed for effective communication in IDL. This involved acquiring appropriate academic language, particularly when dealing with non-contiguous interdisciplinarity across the social science/ natural science boundary.

The latter could be exemplified in ESD where both natural science and social science disciplines are integrated. Another concern under the heading of communication was in understanding the roles and approaches to learning of student peers and tutors.

7.4 Transitions to Interdisciplinary learning

Student experiences of the transition to IDL depend on the nature of course recruitment and nature of the course. Paralleling the words of Adams and Zander (2004) when writing about disciplinary cultures, 'brushing' with interdisciplinary learning does not make students active participants. Students may find the IDL approach initially discomforting but this is outweighed by the learning and empowerment it provides. Students reflecting on the transition normally see considerable value in the IDL approach but are not always aware of IDL as a key element of learning at the time.

It is important for staff to emphasise from the outset that interdisciplinary study does not require students to abandon their disciplines but to draw from them in an interdisciplinary learning context. Some students from specific discipline backgrounds (e.g. geography, which has 'within discipline' variations in learning approaches) seem to find the transition smoother than others. It is therefore important to identify how different disciplinary groups experience the 'transition' to interdisciplinary learning. This includes their associated 'induction' needs for IDL as a platform for the transition and as a springboard for PGT success.

7.5 Learning design for IDL and co-learning communities

There were varying degrees to which IDL was an explicit and planned part of course design from well integrated to low integration, with 'bolt on' elements or interdisciplinarity manifesting itself only in the latter stages of a course. There were also varying degrees to which the strengths of the interdisciplinary nature or elements of the course were communicated to students at the outset, during the course and at end of the course. Learning design for IDL lends itself to active and advanced problem-based learning approaches that can be combined with sustained peer learning and the development of dynamic and effective co-learning communities.

The facilitation of co-learning communities involves giving particular attention to drawing on the strengths of peers and the integrating role of tutors. Peers from different discipline backgrounds can have an important role in interdisciplinary learning if what they bring to the table is made explicit and critically reflected on by themselves and other community members. This can be linked to discussions around the character of disciplines (see Section 4.3). There are ways of developing awareness of the strengths of different disciplinary backgrounds alongside other elements of diversity (McEwen *et al*., 2008).

> 'In fostering respect for multiple forms of diversity among students it is important to recognise and capitalise on strengths within the group. Ice-breaker activities can perform this function and foster peer support and respect. Sample activities include: […]Getting students to write a piece in the language and style of their disciplinary home, then unpicking the differences in the examples and writing collaboratively on an interdisciplinary theme (e.g. sustainable development principles and practice).' (McEwen *et al*., 2008, p. 110/111)

The building of effective learning communities also poses questions about the links between the effectiveness of learning and different communication styles and how the relationship between international/ intercultural experiences is similar to interdisciplinary experience and competence (cf. Becher, 1989).

The role of staff, particularly the course leader, can be very significant as facilitator and role model in IDL. At PGT level, staff can also have a role as learners and this applies particularly to IDL where discipline-based staff may be developing their experiences of IDL alongside the students. Our limited research of the staff experience of IDL concurs with that of Toynton (2005) in acknowledging the learning challenges and opportunities that interdisciplinarity presents for staff as 'learners' in the Institute for Lifelong learning at the University of Sheffield:

> 'Where tutors from various disciplines present sessions jointly, learning occurs between tutors as well as between learners and between tutors and learner...Tutors therefore have to be willing to share roles within a less hierarchic learning community' (Toynton, 2005, pp. 114-115).

If staff are already engaging in interdisciplinarity in their other academic activities, including research or knowledge exchange, then the processes of engaging and adapting to IDL can be easier and make more likely the proactive and explicit harnessing of the opportunities of IDL.

7.6 Learning outcomes associated with IDL

IDL crosses traditional disciplinary boundaries, raising issues about what kinds of information and knowledge exchange occurs. In this study, we found that although the precise learning outcomes varied with the discipline mix, there were some common declared learning outcomes mentioned regularly by students in open and closed questions. These included holistic thinking and the ability to synthesise/integrate ideas from different disciplines, and the ability to make unique connections between different theoretical perspectives. Students perceived significant potential for the development of higher order critical thinking skills and problem solving skills. However, students did not articulate many of the metacognitive skills from Ivanitskaya *et al.* (2002)'s listing (Table 6) suggesting that more awareness raising and reflection is needed. Other learning outcomes frequently mentioned included higher level communication and language skills; again parallels with the skills developed in intercultural learning can be made.

More generally, PGT learning particularly within 'discipline conversion' courses tends to put lesser emphasis on the building of bodies of knowledge. Students still expressed some concerns about IDL in a knowledge building context. Some tensions were identified between the building of depth of single subject knowledge that many students had experienced on a smaller scale in their undergraduate courses and the experiences in their interdisciplinary Master's course of engagement with a wider set of perspectives and skills (cf. Ivanitskaya *et al*., 2002).

There is a need to look specifically at designing effective assessment for IDL (cf. Field and Stowe, 2002) so that it targets the required and declared learning outcomes while leaving space for the serendipitous ones. Assessment for disciplinary learning cannot

easily be adapted for IDL; fresh thinking is frequently required. Good practice might include assessments that in terms of their subject matter draw on different philosophical perspectives and different methodological approaches and at PGT level involve critical evaluation and reflection. Assessment involving advanced problem-solving or PBL lends itself to students using IDL perspectives to determining potential solutions. Some of the key ways that design of the assessment process might provide opportunity for IDL is through group work, with learning sets or learning circles and peer support and critique in the process of assessment. There are various ways that this might be set up in face-to-face and 'virtual' settings.

7.7 Interdisciplinary and different types of learning style

In the student group, learning styles varied on the basis of previous disciplinary background but also previous learning design and approaches to learning in their undergraduate HEI. Some international students had experienced significant elements of rote learning with a highly prescribed curriculum. Learning styles therefore combined both preferred and trained elements conditioned by the previous learning experience. Students commented on the need to understand the roles and approaches to learning of student peer learners and tutors. Both staff and student perceptions indicated that it helps if staff have had some engagement with interdisciplinarity rather than simply teaching their discipline in a 'bolt on' teaching and learning context. It is argued that the increasing interdisciplinarity of research can only be helpful in this respect.

7.8 IDL and 'skills for employability'

Students generally perceived interdisciplinary learning outcomes with transferable higher level skills as sitting well with vocationality, employability and workplace preparation, although few mentioned these unprompted. A key theme here was that experience of interdisciplinarity can mimic the workplace providing the opportunities for learning to work with people from diverse backgrounds/disciplines as a valuable vocational skill. Concerns were raised about possible employer perspectives of (and appreciation of the benefits of) interdisciplinary courses and how this might impact on related employment prospects. These included that employers might be looking for specialists rather than those who can engage broadly across disciplines. This links to student perceptions that IDL could lead to a 'watering down' of knowledge and abandonment of disciplinary specialisms. HEI liaison with potential employers around the benefits of IDL might reassure students about the links between IDL and employment prospects.

7.9 IDL and ESD

There are many parallels between IDL and ESD that allow ESD to be an excellent test bed both for reflecting both on the evidence about the potential of different forms of IDL and for developing good and innovative practice in IDL at taught postgraduate level n a challenging context. Both IDL and ESD as processes are multivariously and loosely defined, with different stakeholder understandings seen as both an opportunity and a challenge. This flexibility of interpretation allows a mutual buying in by different stakeholders while misunderstandings may occur about what the learning activity actually involves. This is compounded in the case of ESD by the large number of

definitions of sustainable development itself. In both ESD and IDL understandings are not static but continue to evolve over time.

It would be counter to the learning ethos (and difficult) to deliver an ESD course without an IDL element. SD with its three pillars of environment, economics and society requires non-contiguous interdisciplinarity with the potential for third order learning (transformative-intentional; see Section 4.1). The evidence from this study strongly supports that IDL and ESD foci can be considered mutually supporting. Many of the skills sought in ESD can be mapped onto those declared as potential outcomes from IDL (see Table 9). Students perceived courses that focus on ESD with an explicit IDL approach allow opportunities for transferable and complementary skills development. Holistic thinking was frequently mentioned, as was 'systems thinking' but not by name. As with more generic IDL learning more generally, students that combined ESD and IDL at PGT level were not fully aware of the range of potential learning outcomes from IDL. This has implications for how they focus and reflect on their skills development and how they market themselves.

Increased employability and development of personal capital provide other sound reasons for developing students' engagement with IDL in an ESD context. As a key element of ESD involves the application of interdisciplinary perspectives and skills learnt, the links between learning and employability and practice are explicit. Skills like holistic thinking and advanced systems thinking and more serendipitous 'thinking outside the box' are key skills for 'earth literate leaders' (c.f. Martin and Jucker, 2005). There are also opportunities for developing transdisciplinary learning as part of the approach to developing ESD (see Selby, 2006). This is particularly so in definitions of transdisciplinary learning that go beyond the academic 'involving non-academic practitioners working with academics to identify, research and develop solutions to real world problems' (see Table 3).

8. Conclusions and recommendations

- The student questionnaire response rate in this project enforced a more qualitative approach to exploring the students' learning experiences. It was not possible to make explicit comparison between IDL provision between old and new universities but evidence suggested that there were other key variables that might impact on the nature and quality of the IDL learning experience. A number of different themes and issues were identified and explored. The student learning experience was generally positive but not always explicitly considered interdisciplinary.

- IDL has many facets beyond the learning design and process including the character of the course focus and the nature of the learning community.

- PGT cohorts are increasingly diverse, with discipline base as only one facet of diversity. Different cultural contributions and associated prior learning experiences can be more overt in the character of peers. In this context, there are some important parallels between the functioning of cultures and disciplines. The relationship between international/intercultural experience and learning and communication styles is similar to interdisciplinary experience and competence.

- The nature of interdisciplinary learning at PGT level crosses traditional boundaries, raising issues about what kinds of information and knowledge exchange occurs. It is important to make clear to taught postgraduates that interdisciplinary study does not require students to abandon their disciplines but draw constructively from them. Effective IDL at this level involves capitalising on the existing knowledge, understanding, abilities, motivations and conceptions/ learning styles that students bring from their disciplinary homes.

- The nature of the skill development in IDL particularly lends itself to learning outcomes at PGT level, where there is an emphasis on advanced transferable skills and metacognitive skill development. However, the optimisation of student skill development through IDL requires students to be aware of the IDL context. In addition, it is beneficial for staff to have specific development in how IDL can be facilitated to maximise the learning outcomes through active, empowered IDL.

- IDL does not happen without planning and support. It can be about overcoming limitations and converting potential challenges into strengths.

- The increasing interdisciplinarity of research and staff exposure to this research activity have positive implications for research/teaching relations at PGT level. There are benefits where staff who already discuss or deliver interdisciplinary research or practice together, teach as part of the same team.

- The role of staff in facilitating student development and application in IDL needs further exploration, in particular staff input to formal and informal learning environments.

- Students perceive that staff act as key role models in interdisciplinary learning. The less hierarchical learning environments at PGT level provide the opportunity for the development of IDL environments where the prior learning experiences of both students and staff can be brought to the learning table. The integrating role of the course leader is particularly pivotal.

- It would be beneficial to have more systematic engagement with employers around a SWOT analysis of IDL. This may allay student fears about knowledge depth and employability while emphasing the varied vocational skills from IDL.

- ESD and IDL are highly synergetic in terms of the subject focus, learning processes and learning outcomes. ESD provides an excellent opportunity for trialling approaches to IDL that have IDL in all elements including the subject focus, prior students' disciplinary experiences, the building of learning communities and active approaches to learning and assessment.

8.1 Recommendations

The research project focusing on students' learning experiences of IDL at PGT level has identified a number of elements of recommended good practice.

- Good practice makes the learning outcomes from IDL explicit to students from the start of the course (and ideally earlier).

- Tailored inductions to IDL are needed to support the transitions to IDL among different student groups with different prior disciplinary and other learning experiences.

- Different potential facets of interdisciplinarity should be systematically targeted in terms of learning design for the effective development of IDL communities. This includes capitalising on opportunities for group-based peer learning; developing staff as participants in, and integrators of, learning; and using approaches to learning and the subject matter itself that are inquiry and problem-based.

- Assessment needs to be planned for interdisciplinary learning outcomes and to embrace both planned and serendipitous outcomes.

- Formative assessment for IDL should be team set, supported and assessed.

- The link between IDL and the vocational skills needed in preparation for the workplace should be made explicit in PGT provision that is delivering on both M-level academic and vocational outcomes.

- The learning outcomes associated with IDL should be communicated effectively and discussed with other stakeholders including practitioners and potential employers.

- Staff development for IDL in a PGT context should involve exploration about the staff role formally and informally in the development of effective IDL. It should also involve a SWOT analysis of IDL and an awareness-raising of how the opportunities for IDL can be optimised.

- The results of research exploring the relationships between IDL and ESD should be promoted more widely to other IDL contexts.

8.2 Further research

The research has generated several questions for further exploration. Extended work and larger student and staff samples beyond the two pilot HEIs are needed to explore specific themes further. Some indicative questions are provided below.

- How does the mix of disciplines influence the character of the PGT student learning experience?

- Does IDL in itself have a dominant learning style or is this influenced by the character of the constituent disciplines and their degree of intellectual proximity?

- How can the learning design of PGT courses be set up to maximise the higher level learning outcomes from IDL?

- How do different disciplinary groups experience the 'transition' to IDL and what are their associated support needs?

- How do different personal learning styles associated with disciplinary homes and previous learning experiences adapt to IDL?

- How can the different facets of the IDL (including course character; cohort character; learning styles) interact to most benefit in the student learning experience?

- How can assessment best be developed to encourage higher level learning outcomes (and students' awareness of these potential outcomes)?

- How can staff best facilitate IDL in the classroom and other settings?

- What are employer perspectives on IDL in providing knowledge and skills training in preparation for the workplace?

- How can what is being learnt about delivery of ESD in different types of disciplinary settings be cascaded to other less developed IDL contexts?

References

Ackerman, D. B. (1989) Intellectual and practical criteria for successful curriculum integration. *In:* Jacobs, H. H., ed. *Interdisciplinary curriculum: design and implementation*. Alexandria, VA: Association for Supervision and Curriculum Development, 25-38.

Ackerman, D. B. and Perkins, D. N. (1989) Integrating thinking and learning skills across the curriculum. *In:* Jacobs, H. H., ed. *Interdisciplinary curriculum: design and implementation*. Alexandria, VA: Association for Supervision and Curriculum Development, 77-96.

Adams, K. and Zander, A. (2004). *Postgraduate Induction: Emerging Evidence from a Discipline-based Program*. AUQA: Proceedings of the Australian Universities Quality Forum 2004. Available from:: http://www.auqa.edu.au/auqf/2004/program/papers/Zander.pdf [Accessed 12 February 2008].

Baines, J., Cohen, J., Martin, S. (2005) United Kingdom: Skills Development for the 21st Century. *Prospects*, **35**, 355-365

Bauer, H. (1990) Barriers against interdisciplinarity: Implications for Studies of Science, Technology and Society. *Science, Technology & Human Values* **15** (1), 105-120.

Becher, T. (1989) *Academic Tribes and Territories: Intellectual Enquiry and the Culture of Disciplines.* Milton Keynes: SRHE and Open University Press.

Becher, T. and Kogan, M. (1992) *Process and structure in Higher Education*. Routledge, London.

Becher, T. and Trowler, P. (2001) *Academic Tribes and Territories: Intellectual Enquiry and the Culture of Disciplines.* Milton Keynes: Open University Press.

Biggs, J. and Collis, K. (1982) *Evaluating the Quality of Learning: The SOLO Taxonomy.* Academic Press, New York.

Bradbeer, J. (1999) Barriers to Interdisciplinarity: disciplinary discourses and student learning. *Journal of Geography in Higher Education*, **23** (3), 381-396.

Brewer, G. D. (1999) The challenges of interdisciplinarity. *Policy Sciences,* **32**, 327-337.

Chettiparamb, A. (2007) *Interdisciplinarity: a literature review. A report for the Higher Education Academy.* Southampton: Higher Education Academy Interdisciplinary Teaching and Learning Group.

Dalrymple, J. and Miller, W. (2006) Interdisciplinarity: a key for real-world learning. *Planet,* **17**, 29-31. Available from: http://www.gees.ac.uk/planet/p. 17/p. 17.pdf [Accessed 12 February 2008]

Dawe, G., Jucker, R. and Martin, M. (2005) *Sustainable Development in Higher Education: current practice and future developments. A report for the Higher Education Academy.* York:

Higher Education Academy,. Available at: http://www.heacademy.ac.uk/ourwork/learning/sustainability. [Accessed 4 September 2007]

Dinmore, I. (1997) Interdisciplinarity and Integrative Learning: An Imperative for Adult Education. *Education*, **117**, 452–467.

Eastwood, D. (2005) A growth market: the increase in taught postgraduate numbers in the environmental sciences. *Planet*, **14**, 7.

El Ansari W., Pearson D. and Davis T. (2002) Satisfaction with interprofessional multidisciplinary education? Influences of learners' demographic and academic characteristics. *Journal of Interprofessional Care,* **16** (2), 174-175.

Entwistle, N. (2003) *Concepts and conceptual frameworks underpinning the ETL project*. ETL Project Occasional Report 3. Available from: http://www.tla.ed.ac.uk/etl/docs/ETLreport3.pdf [Accessed 12 February 2008].

Felder, R. M. (1996) Matters of style. *American Society for Engineering Education Prism* **6**, 18-23.

Field, M., Lee, R. and Field, M. L. (1994) Assessing interdisciplinary learning. *New Directions for Teaching and Learning*, **58**, 69-84.

Field, M. and Stowe, D. (2002) Transforming Interdisciplinary Teaching and Learning through Assessment. In: Hayes , C., ed. *Innovations in interdisciplinary teaching*. Washington: Oryx Press, 256-274.

Fink, L. D. (2003) *Creating Significant Learning Experiences: An Integrated Approach to Designing College Courses*. San Francisco: Jossey Bass Higher and Adult Education Series). Available from: http:www.ou.edu/idp/significant/WHAT%20IS.pdf. [Accessed 30 June 2007]

Fowler, L., McGill, D., Armarego, J. and Allen, M. (2002) *Quantitative learning conversations: Constructivism and its application to learning in an engineering environment*. Available from: http://www.ecu.edu.au/conferences/herdsa/main/papers/ref/pdf/Fowler.pdf [Accessed 22 September 2007]

Gibbs, G. (1988) *Learning by doing: a guide to teaching and learning methods.* London: Further Education Unit,. Available from: http://www.glos.ac.uk/gdn/gibbs/index.htm [Accessed 12 February 2008]

Graybill, J. K., Dooling, S., Shanda, V., Withey, J., Greve, S. and Simon, G. L. (2006) A Rough Guide to Interdisciplinarity: Graduate Student Perspectives. *BioScience*, **56** (9), 757-763

Guilfoyle, A., and Halse, A. (2004) Community, diversity, learning and planning: exploring international postgraduate student's transition experiences. Proceedings of

EDU-COM 2004, *NewChallenges for Sustainability and Growth in Higher Education*, Perth, WA: Edith Cowan University, 135-147.

Hansson, B. (1999) Interdisciplinarity: For what purpose? *Policy Sciences* **32**, 339-343.

Healey, M., Kneale, P. and Bradbeer, J., (2005) Learning styles among geography undergraduates: an international comparison. *Area* **37**, 30-42.

Higher Education Academy (2005) *Sustainable Development in Higher Education. Current Practice and Future Developments. A Progress Report for Employers, Unions and the Professions.* York: Higher Education Academy. Available from: http://www.heacademy.ac.uk/assets/York/documents/ourwork/tla/sustainability/web0466_sustainable_development_in_higher_education_executive_summary_2005.pdf [Accessed 12 February 2008]

Higher Education Academy (2007). *Postgraduate Research Experience Survey: Final Report.* York: Higher Education Academy. Available from: www.heacademy.ac.uk/assets/York/documents/ourwork/research/surveys/pres/PRES.pdf

Ivanitskaya, L., Clark D., Montgomery G. and Primeau R. (2002) Interdisciplinary learning: process and outcomes. *Innovative Higher Education* **27**, 95-111.

Jennings, R. (2003) Authority and authenticity: Whose Australian studies is it? Crossings, **8** (2). Available from: http://www.inasa-crossings.net/ [Accessed: 12 January 2008].

Jennings, R and Hassam, A. (2004), Why Study Australia? An On-line Survey of UK Students. *In* Carter, D., Worby, G. and Darian- Smith, K., eds. *Australian Studies: Teaching Across Cultures*. St Lucia: UQP.

Kagawa, F., Selby, D., and Trier, C. (2006) Exploring student's perceptions of interactive pedagogies in education for sustainable development. *Planet* **17**, 53-56.

Karlqvist, A., (1999) Going beyond disciplines. *Policy Sciences* **32**, 379-383.

Kennedy, H. (2002) Postgraduate multimedia education: practices, themes and issues. Report from International Institute of Infonomics, School of Cultural and Innovation Studies, University of East London. Available from: http://ecdc.info/publications/reports/cmd_benchmark.pdf [Accessed 27 April 2007].

Kolb, D. A., (1984) *Experiential learning: experience as a source of learning and development.* New York: Prentice Hall.

Lattuca, L.R. (2001) *Creating Interdisciplinarity: Interdisciplinary Research and Teaching among College and University Faculty.* Nashville, TN: Vanderbilt University Press.

Le Heron, R., Baker, R. and McEwen, L. J. (2006). Co-learning: Re-linking research and teaching in geography. *Journal of Geography in Higher Education* **30** (1), 77-87.

Levien, R. (1997) *RAND, IIASA, and the Conduct of Systems Analysis.* Weston, CT: Strategy and Innovation Consulting.

McEwen, L. J., Haigh, M., Smith, S., Steele, S. and Miller, A. (2003) 'Real world' experiences? Reflections of current and past students on practitioner inputs to environmental taught Master's courses. *Planet* **10**, 18-22.

McEwen, L. J. (2005) Postgraduate taught course developments in geography, earth sciences and environment in the UK: an initial assessment of drivers. *Planet* **10**, p.6.

McEwen, L. J., Duck, R., Haigh, M., Smith, S., Wolfenden, L. and Kelly, K. (2005) Evaluating the 'postgraduateness' of vocational taught Masters environmental courses: student perspectives. *Planet* **10**, 18-22.

McEwen, L. J., Monk, J., Hay, I., Kneale, P. and King, H. (2008) Strength in Diversity: enhancing learning in vocationally-orientated, Master's level courses. *Journal of Geography in Higher Education* **32**, 101-120.

Magnier, K. (2006) Sustainability as a troublesome concept in the GEES disciplines. *Planet* 17, 32-33. Available from: http://www.gees.ac.uk/planet/p. 17/km.pdf [Accessed 12th February 2008]

Martin, S. and Jucker, R. (2005) Educating earth literate leaders. *Journal of Geography in Higher Education* **29**, 19-29.

Martin, S., (2005) Sustainability, Systems thinking and Professional Practice. *Systematic Practice and Action Research* **18** (2), 163-171.

Martin, S., Dawe, G., and Jucker, R. (2006) Embedding Education for Sustainable Development in Higher Education in the UK. *In:* Holmberg, J. and Samuelsson, B. E., eds. *Drivers and Barriers for Implementing Sustainable Development in Higher Education*. UNESCO Technical Paper No. 3.

Nissani, M. (1997) Ten cheers for interdisciplinarity: The case for interdisciplinary knowledge and research. *The Social Science Journal* **34** (2), 201-216

OECD, (1972) *Interdisciplinarity – Problems of Teaching and Research in Universities*. Paris: OECD.

Palmer, P. (1998). *The Courage to Teach: exploring the inner landscape of a teacher's life*. San Francisco CA: Jossey-Bass.

Prosser, M., Ramsden, P., Trigwell, K. and Martin, E. (2003). Dissonance in experience of teaching and its relationship to the quality of student learning. *Studies in Higher Education* **28**, 37-48.

Pullon, S. and Fry, B. (2005) Interprofessional postgraduate education in primary health care: is it making a difference? *Journal of Interprofessional Care,* **19**, 569–578.

Salter, L. and Hearn, A. (1997) *Outside the Lines: Issues in Interdisciplinary Research*. Montreal and Kingston: McGill-Queen's University Press.

Salvatori, P. S., Berry, S. C. and Eva, K.W. (2007) Implementation and evaluation of an interprofessional education initiative for students in the health professions. *Learning in Health and Social Care*, **6**, 72–82.

Scheyvens, R., Wild, K. and Overton, J. (2003) International students pursuing postgraduate study in geography: impediments to their learning. *Journal of Geography in Higher Education,* **27**, 309-323.

Selby, D. (2006) The catalyst that is sustainability: bringing permeability to disciplinary boundaries. *Planet* **17**, 57-59.

SEEC (Southern England Consortium for Credit Accumulation and Transfer), (2003) *Credit Level Descriptors for Further and Higher Education*. SEEC, UK. Available from: http://www.seec-office.org.uk/SEEC%20FE-HECLDs-mar03def-1.doc [Accessed on 22 June 2007]

Squires, G. (1992) Interdisciplinarity in Higher Education in the United Kingdom. In *European Journal of Education* **27** (3), 201-210.

Sterling, S. (2001) *Sustainable Education: revisioning learning and change*. Totnes: Green Books.

Toynton, R. (2005) Degrees of disciplinarity in equipping mature students in higher education for engagement and success in lifelong learning. *Active Learning in Higher Education*, **6** (2), 106-117.

Tress, B., Tress, G., and Fry, D. (2003) Potential and limitations of interdisciplinary and transdisciplinary landscape studies. *In:* Tress, B., Tress, G., and Van der Valk, A., eds. *Interdisciplinary and transdisciplinary landscape studies: potential and limitations*. Delta Program, Wageningen Delta Series **2**, 182-192.

Wals, A. and Jickling, B. (2002) Sustainability in higher education: from double think and newspeak to critical thinking and meaningful leaning. *International Journal of Sustainability in Higher Education* **3**, 221-232.

Appendices

Appendix 1: PGT student experience questionnaire
Appendix 2: Themes for consideration in the student focus groups
Appendix 3: Tutor questionnaire
Appendix 4: Indicative histograms summarising the student questionnaire data

THEME 1: Student expectations of interdisciplinary learning

PART A - Previous learning experience

For each statement, please rate the extent of your agreement or disagreement. (1 = Strongly Disagree and 5 = Strongly Agree)

1. My previous undergraduate course focused on a single relevant discipline.

2. I feel a strong academic association with my disciplinary background.

3. I bring a well-defined body of knowledge from my disciplinary background.

4. My disciplinary background uses specific or well acknowledged methods.

5. There are well established modes of communication with others from my disciplinary background

6. I am confident in communicating with others within my disciplinary home

7. My previous undergraduate course allowed me to acquire knowledge in several disciplines but did not integrate them.

8. Individuals from my undergraduate discipline are able to work closely with individuals of other disciplines.

9. Is there anything else that you think is important to state about your previous learning experience?

PART B – Learning styles in previous undergraduate degree

For each set of questions, rank the responses from 1 (least applicable) to 4 (most applicable). Please rank all items and do not use any tied scores.

Please reflect back to your previous undergraduate experience

10.	When I learnt	____	I had to deal with my feelings	____	I was expected to watch and listen	____	I was expected to think about ideas	____	I was expected to be doing things
11.	I learnt best when:	____	I trusted my hunches and feelings	____	I listened and watched carefully	____	I relied on logical thinking	____	I worked hard to get things done
12.	When I was learning	____	I had strong feelings and reactions	____	I was quiet and reserved	____	I tended to reason things out	____	I was responsible about things
13.	I learnt by:	____	feeling	____	watching	____	thinking	____	doing
14.	When I learnt:	____	I was open to new experiences	____	I looked at all sides of issues	____	I liked to analyse things, break them down into their parts	____	I liked to try things out
15.	When I was learning:	____	I needed to be an intuitive person	____	I needed to be an observing person	____	I needed to be a logical person	____	I needed to be an active person

16.	I learnt best from:	____	personal relationships	____	observation	____	rational theories	____	a chance to try out and practise
17.	When I learnt:	____	I felt personally involved in things	____	I took my time before acting	____	I liked ideas and theories	____	I liked to see results from my work
18.	I learnt best when:	____	I relied on my feelings	____	I relied on my observations	____	I relied on my ideas	____	I could try things out for myself
19.	When I learnt	____	I was an accepting person	____	I was a reserved person	____	I was a rational person	____	I was a responsible person
20.	When I learnt:	____	I got involved	____	I liked to observe	____	I evaluated things	____	I liked to be active
21.	I learnt best when:	____	I was receptive and open-minded	____	I was careful	____	I analysed ideas	____	I was practical

22. How well suited was your choice of undergraduate course in relation to your preferred learning styles?

PART C – Transition to present learning experience

23. Interdisciplinary study was one of the factors that attracted me to my present course.

24. The transition to interdisciplinary thinking was well supported by course materials.

25. The transition to interdisciplinary thinking was well supported by tutors.

26. The learning experience has encouraged me to build bridges between my previous and current bodies of knowledge in a meaningful way

27. The learning experience has encouraged me to integrate methods and approaches between my previous and current academic experiences.

28. Prior knowledge from my previous disciplinary background is recognised by students and tutors and gave me confidence in my studies.

29. Prior methodological expertise from my previous disciplinary background is recognised by students and tutors and gave me confidence in my studies

30. I found encountering new knowledge and approaches to study in my interdisciplinary Master's programme difficult.

31. Did you encounter any barriers in the transition between your first degree and postgraduate study?

Theme 2 Perceptions of the teaching-learning environment at taught postgraduate level

PART A: Your general perceptions of your current postgraduate course

For each statement, please rate the extent of your agreement or disagreement. (1 = Strongly Disagree and 5 = Strongly Agree)

32. From the beginning, the benefits of interdisciplinary study were clear to me.

33. I became more confident about interdisciplinary study as the course progressed.

34. Being part of an interdisciplinary learning environment is a major strength of this programme of study.

35. My current postgraduate course allows me to integrate knowledge from several disciplines around a central theme.

36. An interdisciplinary learning environment brings opportunities that monodisciplinary approaches to learning does not have.

37. Interdisciplinary learning is threatened by disciplinary prejudice.

38. Working with students from varied disciplinary backgrounds is a valuable experience.

39. It was clear to me what I was supposed to learn in an interdisciplinary learning context

40. We were given a good deal of choice over how we went about learning.

41. My past disciplinary background provides enriching context to my interdisciplinary study

42. Are there any other points you would like to raise about how you perceive your interdisciplinary leaning environment?

PART B: Experiences of teaching and learning

Please carry out a SWOT analysis of an interdisciplinary learning environment
Indicate in the text box

43. Indicate what are the strengths for learning of an interdisciplinary learning environment?

44. Indicate what are the opportunities for learning of an interdisciplinary learning environment?

45. Indicate what are the weaknesses for learning of an interdisciplinary learning environment?

46. Indicate what are the threats to learning of an interdisciplinary learning environment?

Theme 3 Approaches to learning and studying in an interdisciplinary context.

PART A: Knowledge/ methods areas particularly suited to interdisciplinary learning

47. Which types of modules/units benefit most from learning with students from different disciplinary backgrounds and why?

PART B: Learning styles associated with my current taught postgraduate course

48. When I learn:	__ __	I like to deal with my feelings	__ __	I like to watch and listen	____	I like to think about ideas	__ __	I like to be doing things
49. I learn best when:	__ __	I trust my hunches and feelings	__ __	I listen and watch carefully	____	I rely on logical thinking	__ __	I work hard to get things done

50. When I am learning:	___	I have strong feelings and reactions	___	I am quiet and reserved	____	I tend to reason things out	___	I am responsible about things
51. I learn by:	___	feeling	___	watching	____	thinking	___	doing
52. When I learn:	___	I am open to new experiences	___	I look at all sides of issues	____	I like to analyse things, break them down into their parts	___	I like to try things out
53. When I am learning:	___	I am an intuitive person	___	I am an observing person	____	I am a logical person	___	I am an active person
54. I learn best from:	___	personal relationships	___	observation	____	rational theories	___	a chance to try out and practise
55. When I learn:	___	I feel personally involved in things	___	I take my time before acting	____	I like ideas and theories	___	I like to see results from my work
56. I learn best when:	___	I rely on my feelings	___	I rely on my observations	____	I rely on my ideas	___	I can try things out for myself
57. When I am learning:	___	I am an accepting person	___	I am a reserved person	____	I am a rational person	___	I am a responsible person

58. When I learn:	__ __	I get involved	__ __	I like to observe	____	I evaluate things	__ __	I like to be active
59. I learn best when:	__ __	I am receptive and open-minded	__ __	I am careful	____	I analyse ideas	__ __	I am practical

PART C: Perceptions of co-learning environments for staff and students

For each statement, please rate the extent of your agreement or disagreement. (1 = Strongly Disagree and 5 = Strongly Agree)

60. I am receptive to ideas from other students bringing other disciplinary knowledge and approaches in the class.

61. I am skillful in interdisciplinary teamwork

62. I am comfortable with organising and participating in interdisciplinary projects

63. I believe that interdisciplinary team efforts are important to achieving effective interdisciplinary learning

64. I value co-learning with students from different discipline backgrounds

65. Students' views from different discipline backgrounds were valued in this course

66. There were plenty of opportunities for student co-learning at postgraduate level in an interdisciplinary context

67. Talking with other students from different discipline backgrounds has helped me to develop my understanding.

68. Students from different disciplinary backgrounds supported each other and tried to give help when it was needed.

69. Staff were important role models in interdisciplinary learning.

70. Staff helped us to see how you are supposed to think and reach conclusions in interdisciplinary learning.

71. Talking with staff from different discipline backgrounds has helped me to develop my understanding.

Theme 4: Demands made by a new interdisciplinary course

In this section, please tell us how easy or difficult you found different aspects of **this interdisciplinary course unit**. (*very easy; fairly easy; unsure/not applicable ;fairly difficult; very difficult)*

72. What I was expected to know to begin with.

73. The rate at which new material was introduced.

74. The ideas and problems I had to deal with.

75. The skills or technical procedures needed in this subject.

76. The amount of work I was expected to do.

77. Working with other students.

78. Organising and being responsible for my own learning.

79. Communicating knowledge and ideas effectively.

80. Tracking down information for myself.

Theme 5: Vocationality and interdiscipinary courses

Vocational (or work-place learning) elements of your course include any engagement with practitioners including through sessions in University, project work, work placements or dissertation work.

For each statement, please rate the extent of your agreement or disagreement. (1 = Strongly Disagree and 5 = Strongly Agree)

81. The vocational elements of my course provide good opportunities for interdisciplinary learning.

82. My experiences of work place learning make me more receptive to interdisciplinary approaches to learning.

83. What aspects of interdisciplinary learning provide preparation for the workplace?

Theme 6: Learning outcomes - what you have learned

Now we would like to know how much you feel you have gained from studying on an interdisciplinary taught postgraduate course.

For each statement, please rate the extent of your agreement or disagreement. (1 = Strongly Disagree and 5 = Strongly Agree)

84. I can communicate knowledge and ideas effectively in an interdisciplinary context to students of different disciplinary backgrounds

85. Interdisciplinary learning has enabled me to engage holistically with problems.

86. I have a better understanding of the strengths and limitations of disciplines.

87. I have developed the ability to establish connections between similar dissimilar contexts

88. I have developed the ability to tolerate ambiguity or paradox.

89. I developed a capacity to perceive a balance between subjective and objective thinking.

90. I am able to communicate knowledge and ideas effectively across disciplinary boundaries.

91. I believe that participation in interdisciplinary learning will strengthen my ability for future professional practice

92. I can conduct effective problem-solving using the knowledge and skills of students/ peers from different discipline backgrounds.

93. I am able to apply an interdisciplinary knowledge structure to new interdisciplinary problems or themes

94. I am competent in organising and being responsible for my own interdisciplinary learning.

95. Are there any other learning outcomes from the course that are relevant to interdisciplinary learning

FINALLY…….

For each statement, please rate the extent of your agreement or disagreement. (1 = Strongly Disagree and 5 = Strongly Agree)

96. I am enjoying being involved in this course.

97. Finally, how well do you think you are doing in this course unit as a whole? Please try to rate yourself **objectively**, based on any marks, grades or comments you have been given.

very well		well		quite well		about average		not so well		rather badly
9	8		7		6	5	4		3	2	1
☐	☐		☐		☐	☐	☐		☐	☐	☐

Please check back to make sure that you have answered every question.

Thank you very much for spending time completing this questionnaire: it is much appreciated.

Appendix 2: Focus group questions

1	Tell us about your previous undergraduate disciplinary experiences	
2	What is your natural learning style?	Kolb etc.
3	What drew you to your current postgraduate course?	
4	What does interdisciplinarity mean to you?	Comparisons with literature definitions
5	Is the interdisciplinarity of your current course something that you have actually thought about?	
6	Tell us about your transition to interdisciplinary learning at postgraduate level.	
7	Did your experience of the transition to interdisciplinary learning encounter any barriers?	Disciplinary identities (philosophies, language of communication, learning styles)
8	Did your experience of the transition to interdisciplinary learning provide any particular opportunities?	Learning, knowledge
9	What are the positives of doing an interdisciplinary course?	Integration of knowledge? Skills? Environment?
10	What are the negatives of doing an interdisciplinary course?	Integration of knowledge? Skills? Environment?
11	What is your experience of the role of fellow students in interdisciplinary learning?	
12	How diverse in terms of disciplinary background is your student group?	Separation of disciplinary background from approaches to learning? (cultural influences).
13	What is your experience of the role of staff in interdisciplinary learning?	
14	Is there a dominant learning style associated with your course?	Degree of prescription? Tutor-led?
15	How does your natural learning style fit with your current course?	
16	How implicit or explicit was the interdisciplinarity in your course's learning activities?	
17	Are you able to give examples of explicit activities that capitalised on the interdisciplinarity of your course?	groupwork; assessment tasks; problem-based learning
18	What for you are the key learning outcomes linked to the interdisciplinarity of course?	
19	What have you learnt in terms of communication skills in doing the	

	interdisciplinary course?	
20	What have you learnt in terms of the way that you approach problems in doing the interdisciplinary course?	Learning outcomes
21	Have your ways of thinking changed through doing the interdisciplinary course?	Thinking holistically; making connections
22	Do you think that your participation in interdisciplinary learning will have an impact on your future professional practice?	If yes, how?
23	Are courses with an ESD focus particularly suited to interdisciplinary learning vis-à-vis other interdisciplinary courses?	And why? Breadth of engagement; engagement with different disciplinary backgrounds; ways of thinking; integrated solutions
24	Do you think that your participation in interdisciplinary learning will have an impact on your practice as a professional in sustainable development?	Steve Martin? Map learning outcomes against ESD.

Appendix 3: Staff questionnaire

Higher Education Academy - Interdisciplinary Master's project
Taught staff experiences of interdisciplinary teaching and learning

Brief introduction to the Project

The Higher Education Academy has funded this project to explore taught postgraduate students' experiences of interdisciplinary learning at the University of Gloucestershire and the University of Dundee. For the purposes of this project, interdisciplinary learning is defined as follows:

'*Interdisciplinary learning is characterised by the integration of multidisciplinary knowledge and skills across a central programme theme*.'

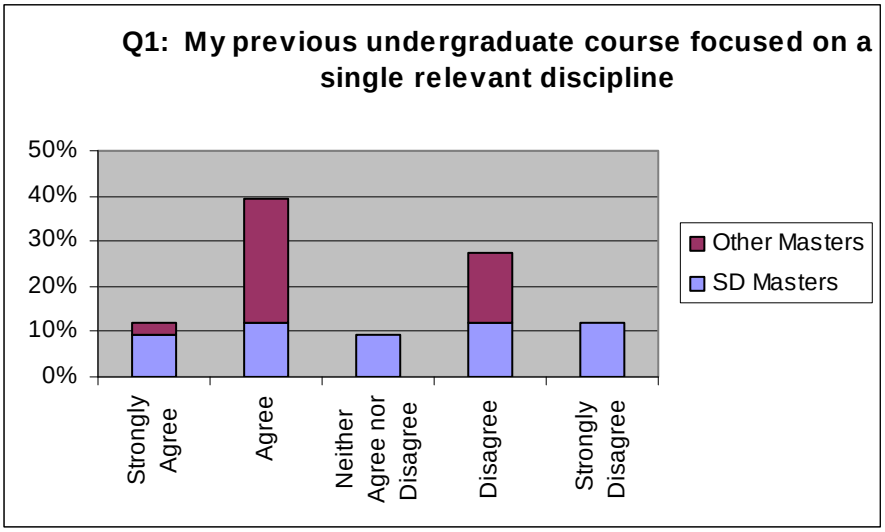
We have carried out a student questionnaire survey and focus groups. We are now keen to have some tutor input to the discussion and would be very grateful if you could provide some responses to the questions below. All responses will be dealt with confidentially.

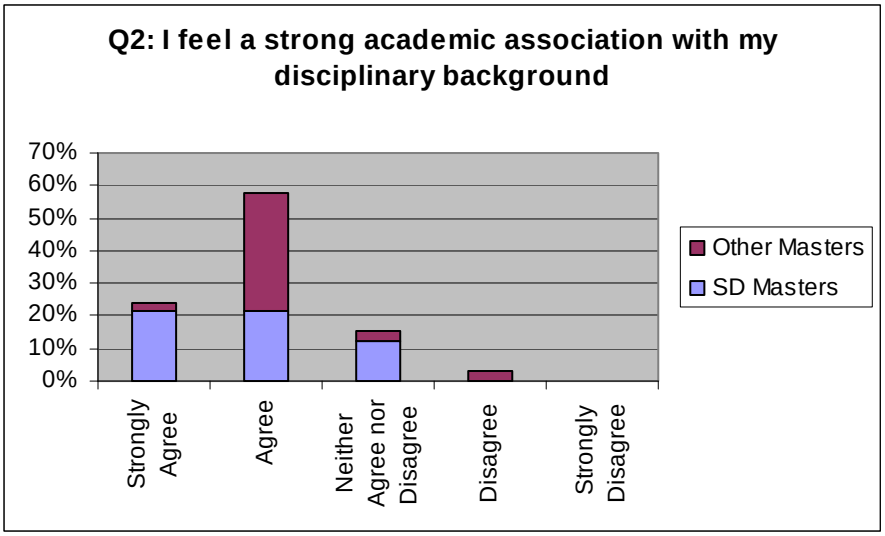
Professor Lindsey McEwen
University of Gloucestershire
Project co-ordinator

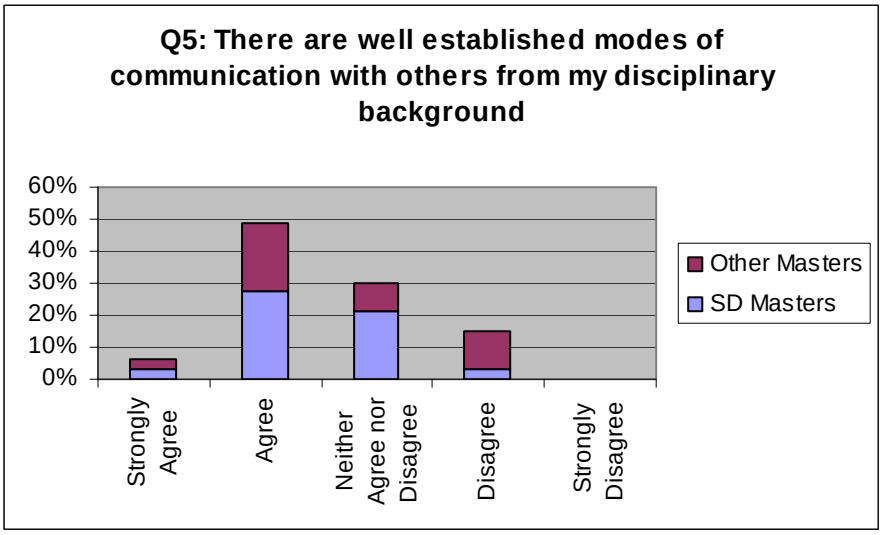
1	Has interdisciplinarity diversified the cohort of students on your Master's course?	
2	Has the diversity of students driven a move towards interdisciplinarity on your Master's course?	
3	How overt is the interdisciplinarity within your course?	
4	What are the positives for students undertaking an interdisciplinary course?	
5	What are the negatives for students undertaking an interdisciplinary course?	
6	What are the opportunities for co-learning among students undertaking your interdisciplinary course?	
7	What is your experience of the role of staff in interdisciplinary learning?	
8	How was the interdisciplinary learning experience for you? (realities of the experience of interdisciplinary teaching)	

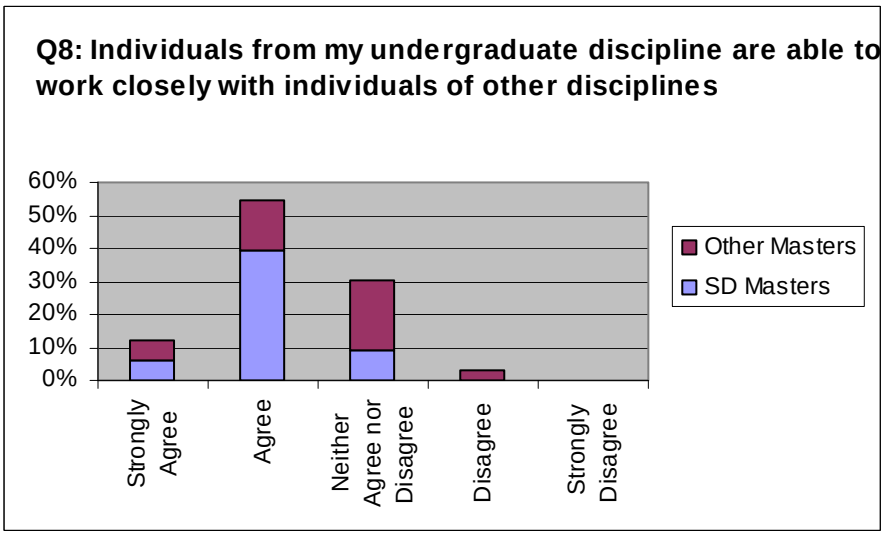
9	How implicit or explicit was the interdisciplinarity in your course's learning activities?	
10	Are you able to give examples of explicit activities that capitalised on the interdisciplinarity of your course?	
11	What skills do students learn through an interdisciplinary Master's course vis-a-vis a disciplinary Master's course?	
	Sustainable development courses	
12	Are courses with an ESD focus particularly suited to interdisciplinary learning vis-à-vis other interdisciplinary courses?	
13	Do you think that student participation in interdisciplinary learning has an impact on a student's practice as a professional in sustainable development?	

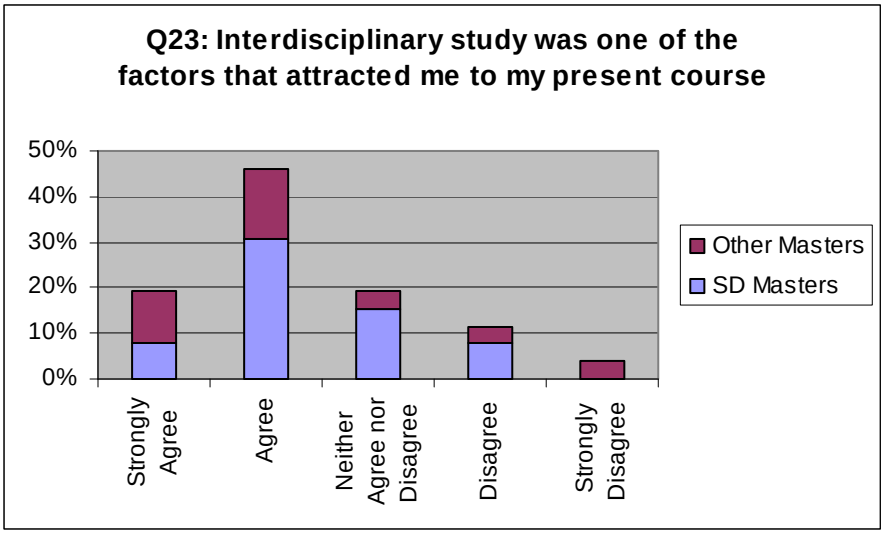
Appendix 4: Indicative histograms summarising the student questionnaire data

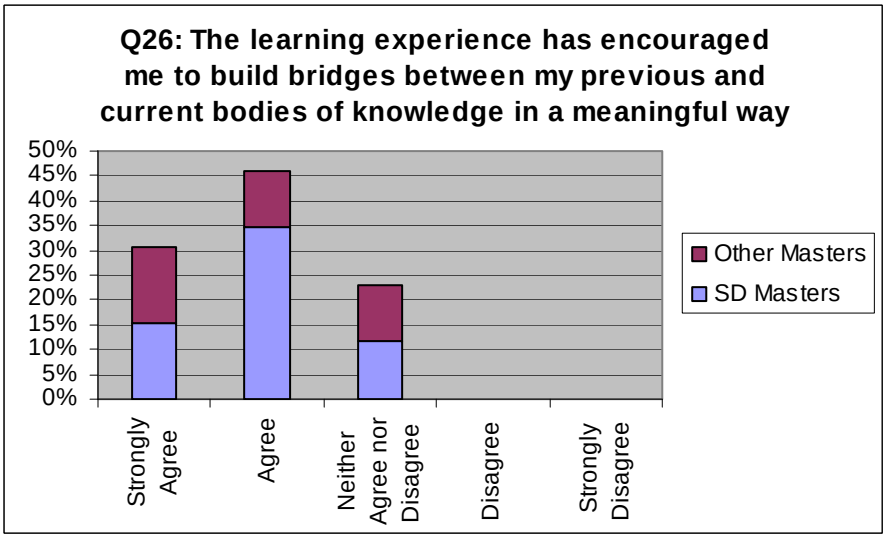


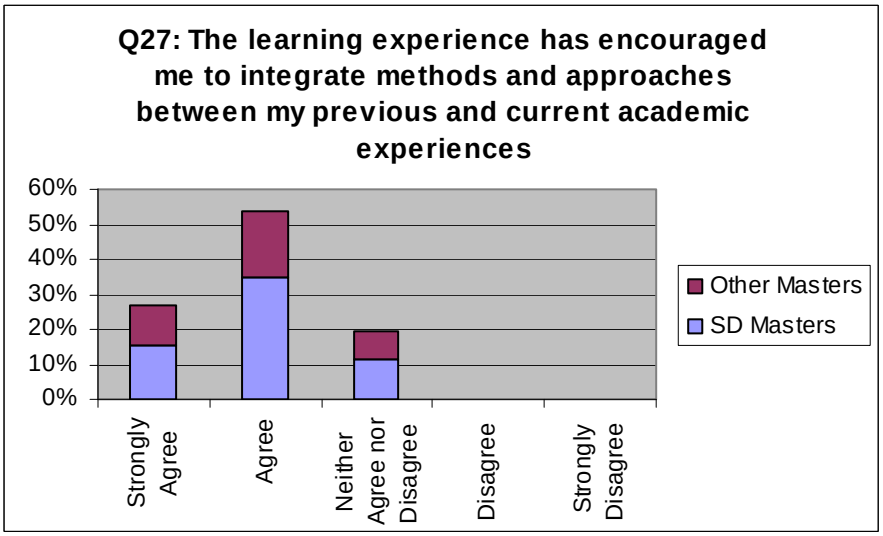

Q2: I feel a strong academic association with my disciplinary background
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

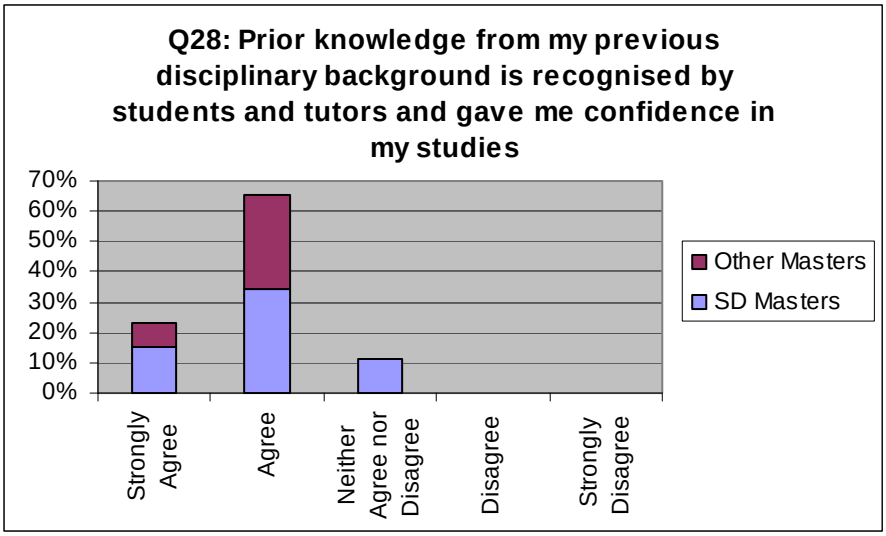

Q5: There are well established modes of communication with others from my disciplinary background
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

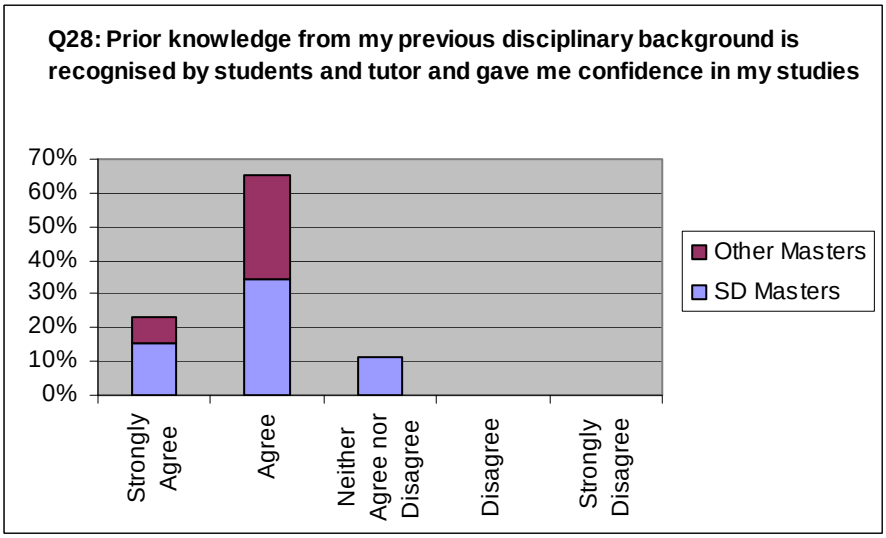

Q8: Individuals from my undergraduate discipline are able to work closely with individuals of other disciplines
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

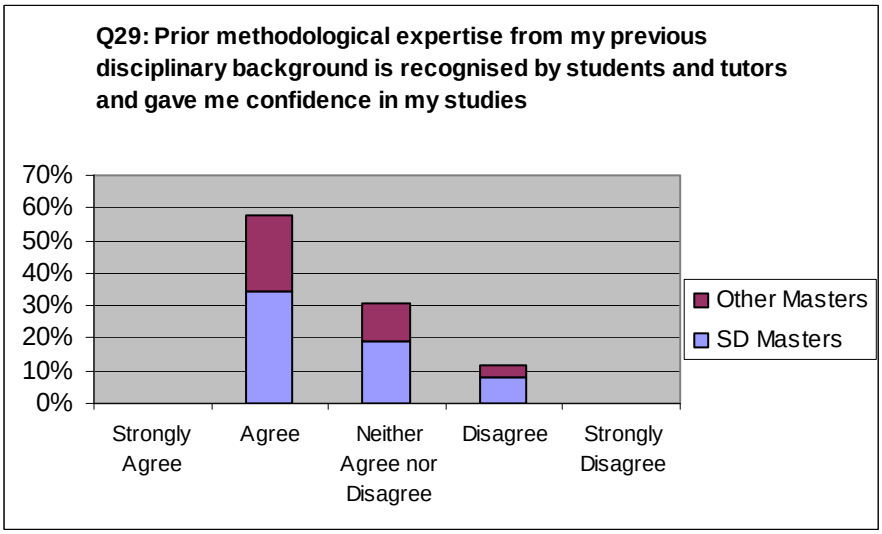

Q23: Interdisciplinary study was one of the factors that attracted me to my present course
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

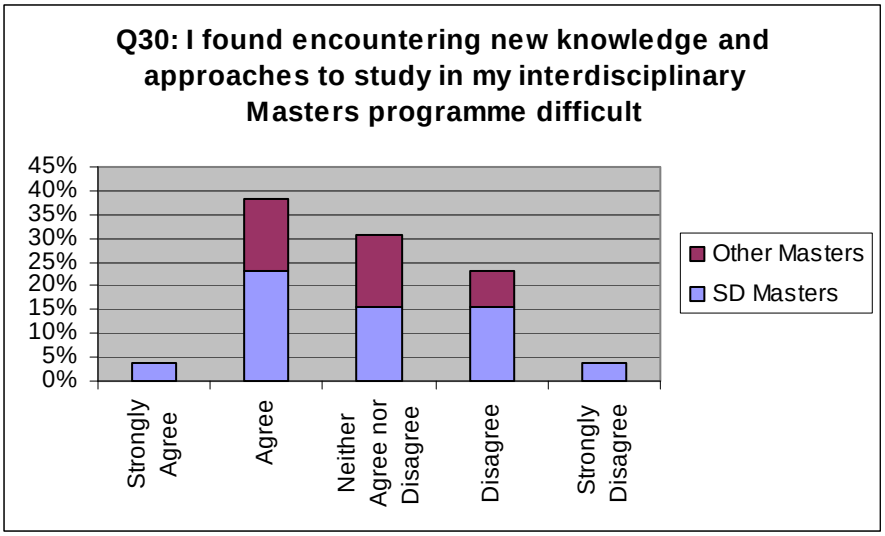

Q26: The learning experience has encouraged me to build bridges between my previous and current bodies of knowledge in a meaningful way
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

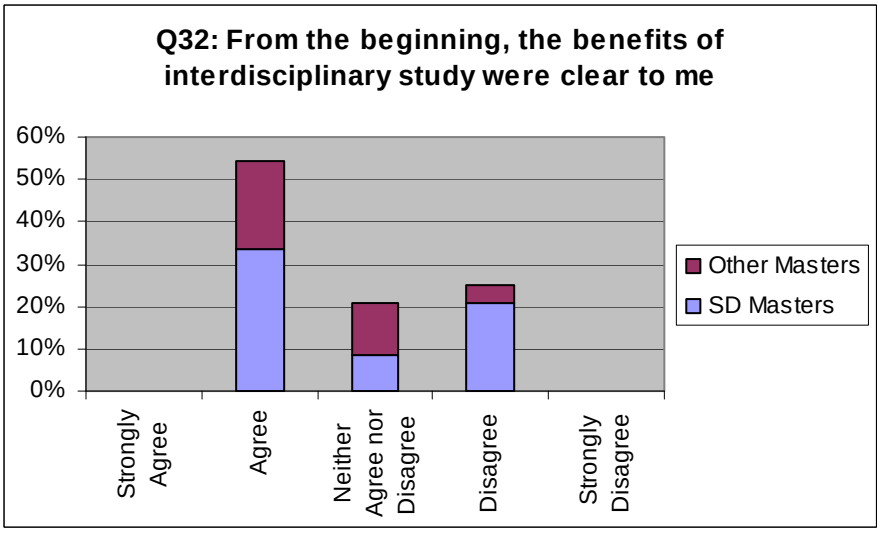

Q27: The learning experience has encouraged me to integrate methods and approaches between my previous and current academic experiences
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

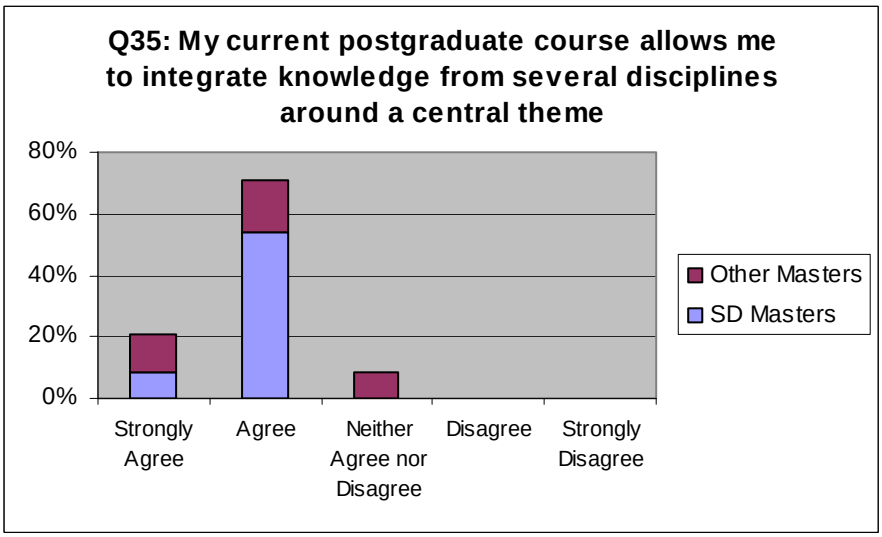

Q28: Prior knowledge from my previous disciplinary background is recognised by students and tutors and gave me confidence in my studies
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

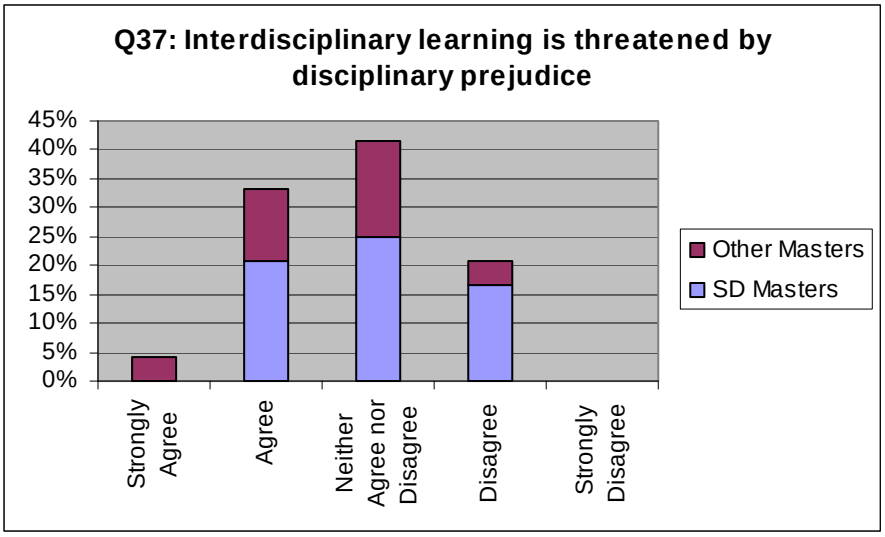

Q28: Prior knowledge from my previous disciplinary background is recognised by students and tutor and gave me confidence in my studies
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

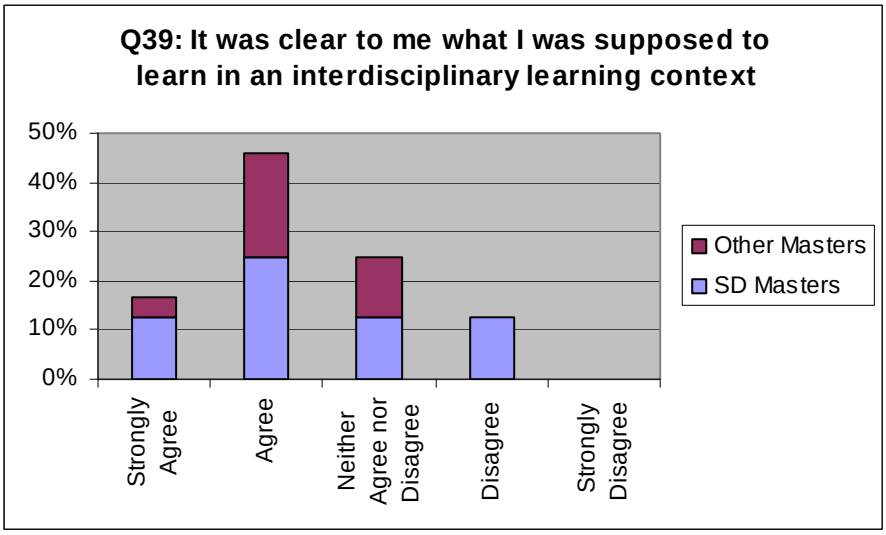

Q29: Prior methodological expertise from my previous disciplinary background is recognised by students and tutors and gave me confidence in my studies
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

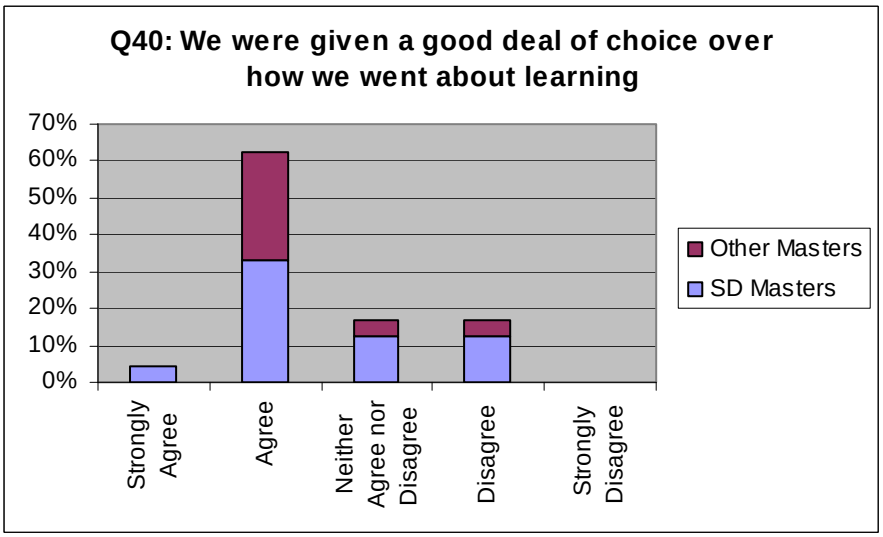

Q30: I found encountering new knowledge and approaches to study in my interdisciplinary Masters programme difficult
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

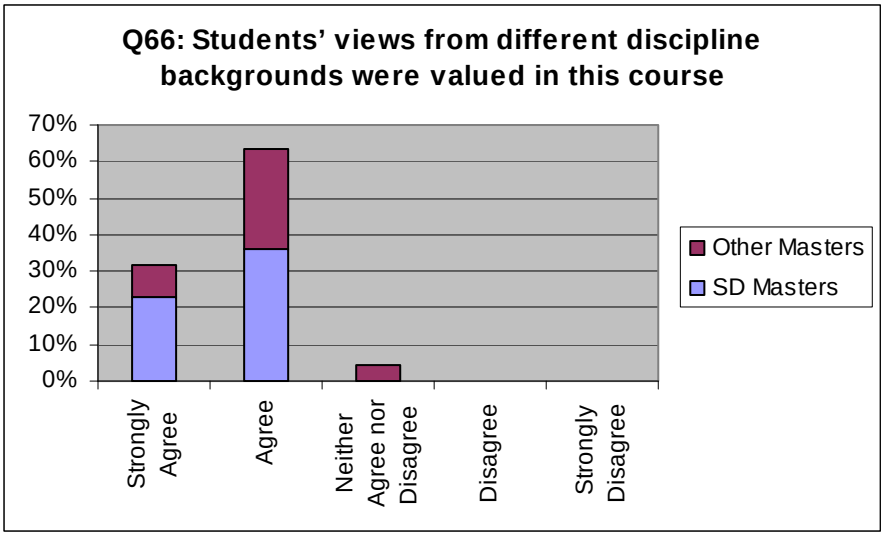

Q32: From the beginning, the benefits of interdisciplinary study were clear to me
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

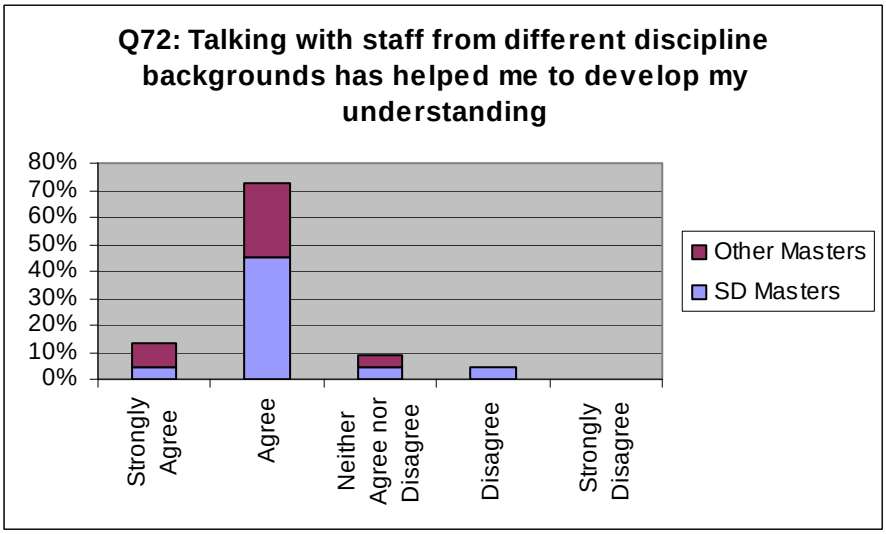

Q35: My current postgraduate course allows me to integrate knowledge from several disciplines around a central theme
80%
60%
40%
20%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters


Q37: Interdisciplinary learning is threatened by disciplinary prejudice
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

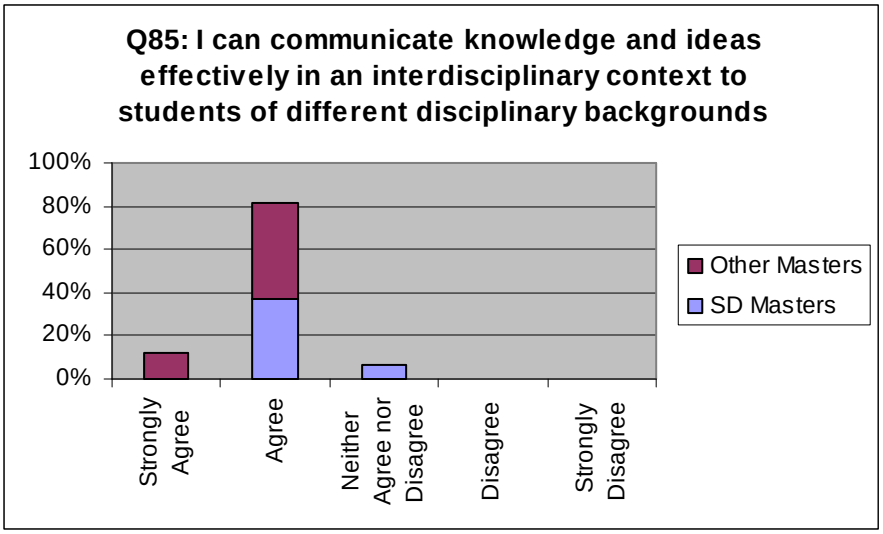

Q39: It was clear to me what I was supposed to learn in an interdisciplinary learning context
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

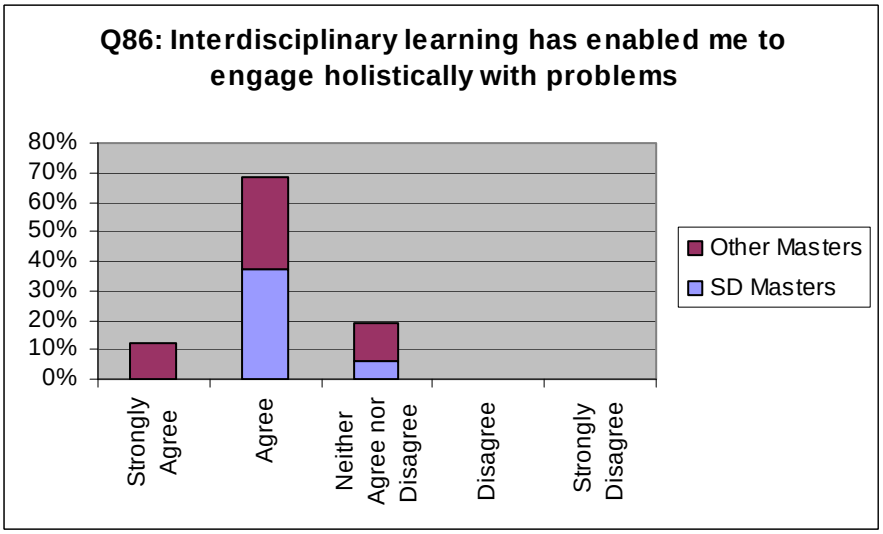

Q40: We were given a good deal of choice over how we went about learning
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

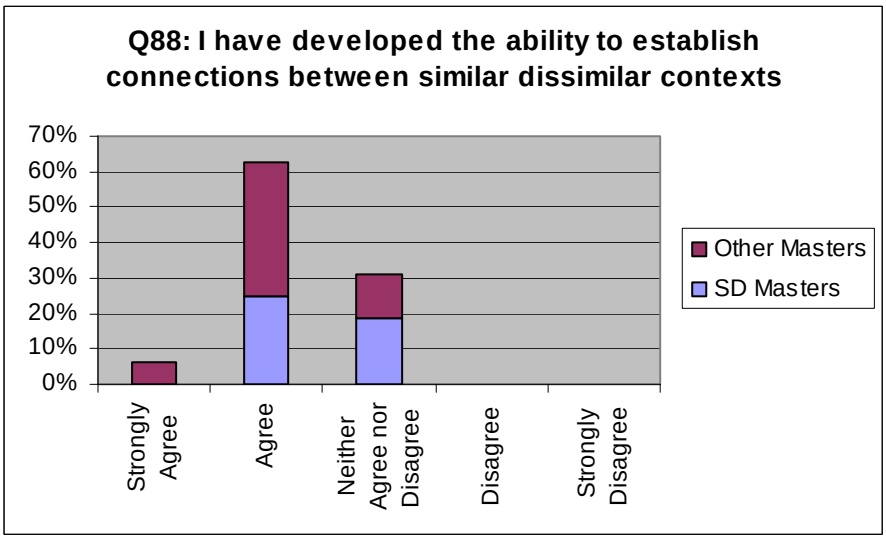

Q66: Students' views from different discipline backgrounds were valued in this course
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

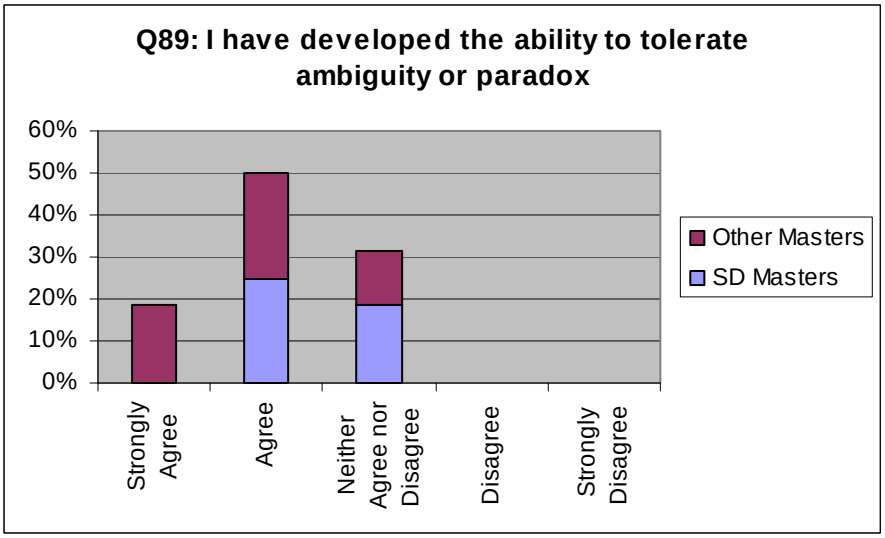

Q72: Talking with staff from different discipline backgrounds has helped me to develop my understanding
80%
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

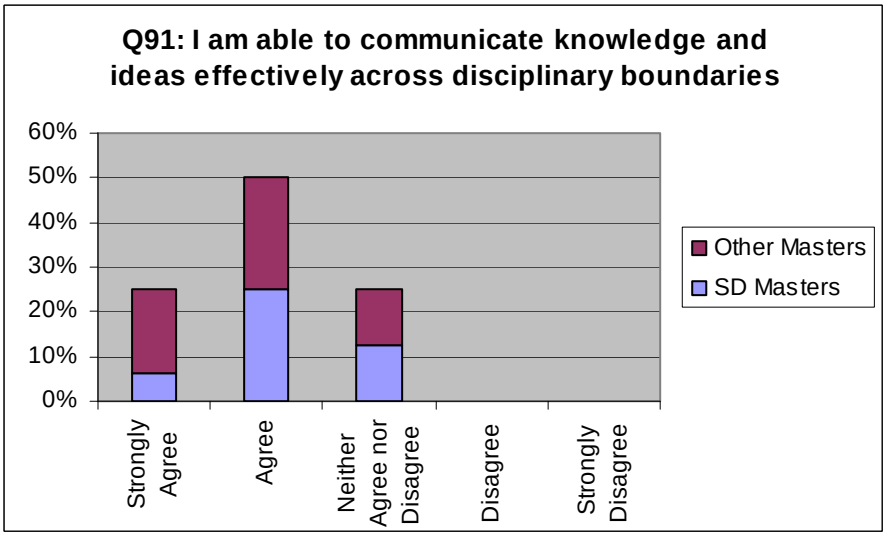

Q83: My experiences of workplace learning make me more receptive to interdisciplinary approaches to learning
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Neither Agree nor Disagree
Strongly Disagree
Other Masters
SD Masters

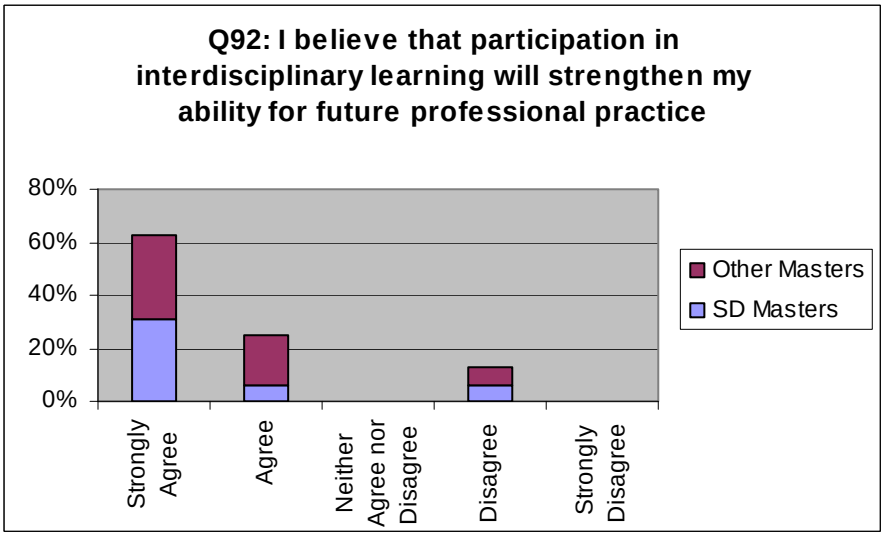

Q85: I can communicate knowledge and ideas effectively in an interdisciplinary context to students of different disciplinary backgrounds
100%
80%
60%
40%
20%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

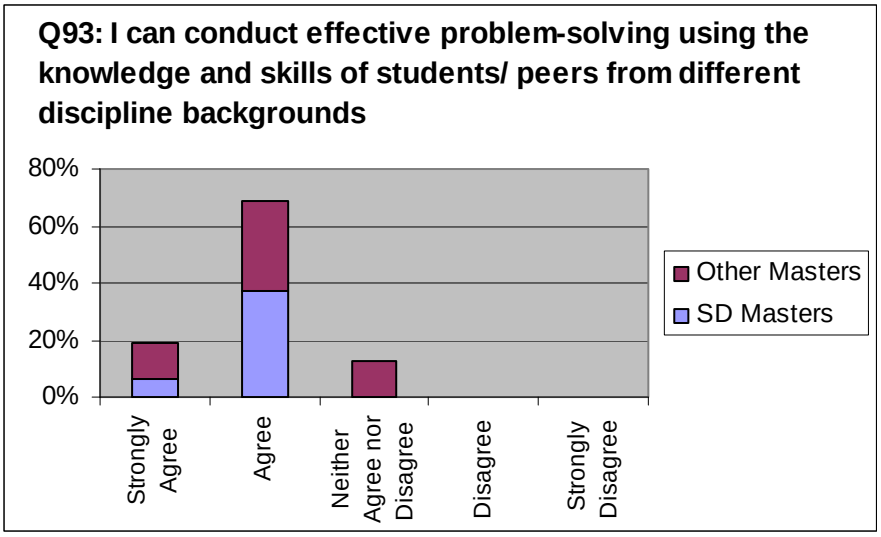

Q86: Interdisciplinary learning has enabled me to engage holistically with problems
80%
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

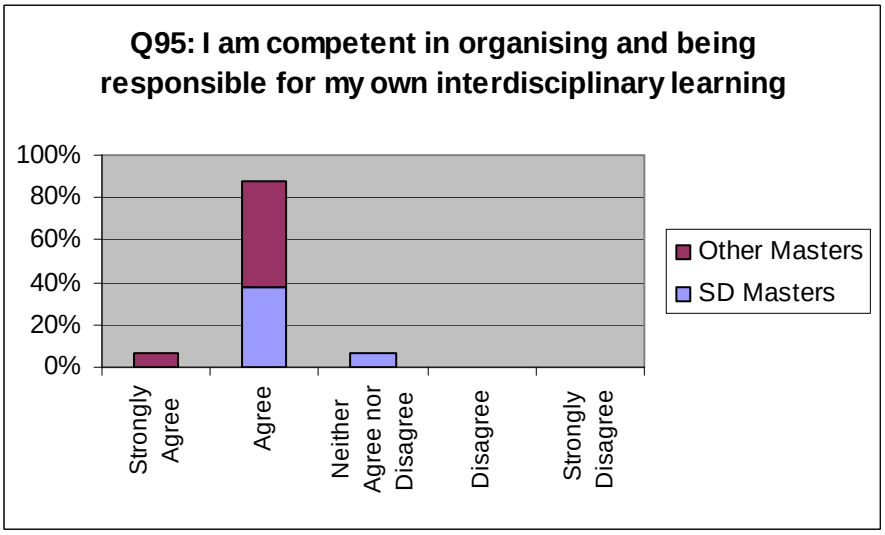

Q88: I have developed the ability to establish connections between similar dissimilar contexts
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters


Q89: I have developed the ability to tolerate ambiguity or paradox
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters


Q91: I am able to communicate knowledge and ideas effectively across disciplinary boundaries
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters


Q92: I believe that participation in interdisciplinary learning will strengthen my ability for future professional practice
80%
60%
40%
20%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters


Q93: I can conduct effective problem-solving using the knowledge and skills of students/ peers from different discipline backgrounds
80%
60%
40%
20%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters


Q95: I am competent in organising and being responsible for my own interdisciplinary learning
100%
80%
60%
40%
20%
0%
Strongly Agree
Agree
Neither Agree nor Disagree
Disagree
Strongly Disagree
Other Masters
SD Masters

Students' experiences of interdisciplinary Masters' courses

ISBN: 978-1-905788-96-5
May 2009

Published by: The Interdisciplinary Teaching and Learning Group, Subject Centre for Languages, Linguistics and Area Studies, School of Humanities, University of Southampton, Southampton, SO17 1BJ.

Tel: 023 8059 4814
Fax: 023 8059 4815
E-mail: llas@soton.ac.uk
www.heacademy.ac.uk/ourwork/networks/itlg

Series Editor: John Canning

The Higher Education Academy
Interdisciplinary Teaching and Learning Group