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An exploration of the characteristics of student nurse personal epistemologies and their relationships to approaches to studying

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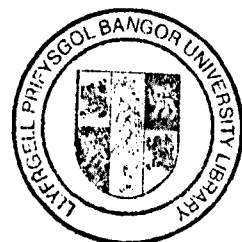
**An Exploration of the Characteristics of Student Nurse Personal
Epistemologies and their Relationships to Approaches to
Studying**

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BSc (Hons), RGN, DN, PGCertHE**

**Thesis submitted to Bangor University for the
Degree of Doctor of Philosophy**

**School of Healthcare Sciences,
College of Health & Behavioural Sciences**

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Abstract

This thesis describes an exploration of the relationships between student nurse personal epistemologies and approaches to studying. It presents an argument for the inclusion of concepts from personal epistemology research into nurse education practice to improve both student-oriented teaching activities and student self-oriented metacognitive activities. Furthermore, this study adds to the evidence base for higher education practice and supports interventions to promote the development of students who are aware of how their beliefs about knowledge affect their approaches to studying.

The study is underpinned by Schommer's Independent Epistemological Belief System model and a conceptual framework derived from personal epistemology and learning styles literature. Personal epistemology (or beliefs about knowledge) has become of increasing interest to educational psychologists and is arguably a relevant area of study for nurse education to inform our understanding of how student nurses approach learning. Personal epistemology has been defined as;

...system[s] of personal or implicit beliefs about the nature of knowledge and learning as a context or set of assumptions within which their learning and thinking take place.

(Paulsen & Wells 1998)

An initial quantitative survey was followed by a qualitative constructivist grounded theory study using a sequential mixed-methods design for the purpose of complementarity and expansion of findings. This approach provided a contextualised description of student nurse personal epistemologies and an understanding of how they influenced the way the students approached studying and learning. A pilot study preceded the main study to enable an examination of the measure of personal epistemology (Epistemic Beliefs Inventory, Schraw *et al* 2002) and to provide theoretical sensitivity for the grounded theory study. The quantitative component results from the main study were used to inform the semi-structured interviews in the grounded theory component of the study. The survey sample size was 197

respondents following the pilot study which had 283 responses. Ten students participated in interviews for the grounded theory study.

The key findings indicate approaches to studying are mediated by epistemological beliefs, but cannot be separated from the social context in which studying occurs. The effects of beliefs were with regard to:

- How students perceived their ability to improve as learners;
- How quickly knowledge could be acquired;
- The medium and process through which that knowledge was obtained.

In addition, results indicated sub-communities of students in the sample population held subtly different beliefs about knowledge and study approaches.

Implications for nurse education practice are that epistemological beliefs play an important, yet subtle part in how students study and learn. Mechanisms for engagement in the form of activities to raise metacognitive awareness and to support learners in their development as knowers are proposed as recommendations for teaching practice.

The implications for further research indicate a need for exploration of how the constructs of personal epistemology can be better modelled and applied to nurse education research. An important area for further study is nurse teachers' epistemological beliefs, how they are expressed in the classroom, and how they extend through the curriculum and the institution. Arguably, this is a relevant and legitimate area for further research because of current issues in nurse education over graduate entry and exit and student attrition rates, which are of international concern.

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Support and encouragement from my colleagues based in the School and within the wider university was essential and some of my colleagues will never know how much they helped during a time of great change and uncertain futures. Acknowledgement of my gratitude is due to immediate colleagues for assisting with student supervision at a time when I needed to really get to grips with thesis production. Thanks to colleagues includes those who provided helpful encouragement along the way on this journey, many of whom have left for other things, but John and Dave deserve a mention for sowing the initial seeds that hooked me on personal epistemology.

Thanks are due to Health Professions Wales for a Research Fellowship in 2004 that really helped to get the project off the ground and provided initial resources for professional development. I would like to express my gratitude to the School of Healthcare Sciences for the opportunity to pursue my interests and to those on the School Ethics Committee who provided advice and encouragement. I have to thank Kenny Forte who gave me permission to use his picture of the Temple of Concord in Sicily in the diagram on page 73.

The children deserve nice Xmas presents this year. Finally, I had much needed help from JM and the dogs, walking up the hill with them was the best way to organise my ideas and stay inspired.

Introduction

Setting the Scene

i) Background to the Study

This study is an investigation of student learning in pre-registration undergraduate nurse education and includes two areas of detailed examination. There is a focus on personal epistemology, which can be conceptualised as an individual's beliefs about knowledge. The second area of enquiry is how an individual's personal epistemology might influence or be related to an aspect of one's learning styles, in this case, approaches to studying. Key experiences which inspired examination of these areas and the research questions in this study were participation in a higher education teaching course and ideas expressed by the students about different subject areas.

The teaching course was a professional development requirement for the university lecturer role and for registration as a nurse tutor with the Nursing and Midwifery Council (NMC 2008). An important element of the course was reflection on teaching and learning experiences whilst working with students studying for their nursing degrees. This prompted questions about the purpose of the nurse teacher role and what influenced how student nurses learn. Also, the students inspired questions because they expressed ideas about learning and attitudes towards particular types of material or subjects. Exposure to different ideas and educational theories during the teaching course lead to specific questions about how knowledge is perceived and constructed by student nurses and how knowledge of these beliefs could influence student approaches to studying.

Personal epistemology opened up a new and challenging theoretical perspective from which these questions could be considered. Research from the field was a stimulus and motivation for investigation of these questions at a fundamental level. As a field of study,

personal epistemology has increasingly become of interest to educational psychologists since the 1990's, particularly in the United States and more recently as a line of international research concern. This interest resulted from the development of various models of beliefs about knowledge (Perry 1970, Belenky *et al* 1986, Schommer 1990, Hammer & Elby 2002, Niessen 2007). Parallel qualitative phenomenographic studies in Europe have focused on the development of student conceptions of learning and approaches to learning and studying, particularly deep and surface learning (Marton & Säljö 1976, Säljö 1979, Marton *et al* 1993). These areas of research and their potential for application in nurse education form a key area of focus for the investigation described in this study.

ii) Study Purpose and Aims

The overarching purpose of this study was twofold, to gain insight into the personal epistemologies of pre-registration student nurses and to examine how these might influence their approaches to studying.

This broad statement of purpose was clarified into specific research questions;

- What are the characteristics of student nurse personal epistemologies?
- What are the relationships between student nurse personal epistemologies and their approaches to studying?

Categories of purpose were adopted as a means to justify the research and methods adopted in this study (Newman *et al* 2003):

- 1) To predict; to build general laws – theory building, from a purely positivist perspective, was not the key purpose for this study, but testing relationships between personal epistemology and approaches to studying using quantitative methods was a means to contribute to the future development of models to inform

educational theory and practice. The aim of the interpretivist grounded theory component of the study was to build a substantive theory to promote understanding of student nurse personal epistemologies and approaches to studying to include social processes and context.

- 2) To add to the knowledge base –through replication of findings from other studies, this research could strengthen existing knowledge and clarify connections between psychological and educational processes. The core ideas of personal epistemology required reframing from a nurse education perspective to make them relevant for practice.
- 3) To have a personal, social, institutional or organisational impact – this study was intended to raise questions about current teaching and learning practice and provide signposts to improve the future, from both a personal perspective and through influencing others via the dissemination of findings. Also, it was a means to potentially deconstruct power structures through examination of the lecturer-student relationship in the light of personal epistemology theory.

The personal impact can be viewed from two perspectives; that of the researcher and that of the participants. Personal reasons for the research study were to improve research skills and competence through the pursuit of an academic award combined with the challenge of production of the thesis. From the viewpoint of the participants, the study could impact on the institution by identifying a useful model of personal epistemology suitable for nurse education. This could be used to influence strategies to assist students in their journey through what is a challenging programme. Furthermore, it could influence how those involved in the delivery of the programme regard knowledge and could inform teaching to promote metacognitive learning activity with those same students in the future.

- 4) To understand complex phenomena – personal epistemology appears to be a complex and abstract phenomenon with limited examination from the perspective

of nurse education. The main reason for this study was to attempt to understand and explain the phenomenon further in relation to student nurses and their approaches to studying.

- 5) To test new ideas; innovations, hypotheses, ideas, solutions – the specific concepts of personal epistemology explored here were relatively new to nurse education and could present innovative ways of working with students to promote metacognitive thought and reflection. Means to facilitate this activity should therefore be rigorously investigated using the most current techniques available.
- 6) To generate new ideas – the reason for this study was to uncover what might be new to the field of personal epistemology with a focus on nurse education and to provide a potentially novel and different viewpoint on knowledge and its acquisition in nursing.
- 7) To inform practice –through the dissemination of findings from the study to different audiences including study participants and through a variety of outlets including written reports or papers, conference presentations seminars and supervision meetings.
- 8) To examine the past; re-interpret, examine tacit mis/understandings, social/historical origins – this study ambitiously set out to build on work of predecessors from a diverse range of disciplines through critical examination of seminal work and subsequent research. The intention was to make a contribution to knowledge for nurse education.

By using this framework, the reasons for this study are made explicit and also provide justification for the researcher's position within it. This furthered the clarification of research questions and added to the validity of the mixed methods study (Newman *et al* 2003).

iii) Summary of the Focus of this Study

This study is relevant and timely for several reasons:

- It can be justified because of the great changes in nurse education and clinical practice and the role of a diverse range of evidence to inform the knowledge base in driving those changes (Rycroft-Malone *et al* 2004). Personal epistemology provides potential for developing a framework or model which could contribute to our understanding of how individual nurses view and evaluate knowledge in their worlds at a fundamentally cognitive level.
- There is a dearth of literature specifically pertaining to student nurse epistemologies and this study may serve to contribute to resolution of this deficit and, at the very least, stimulate development of interest in this area.
- There is limited educational research into the relationships between personal epistemology and approaches to studying and no literature could be found focusing on these links in nurse education.
- Finally, personal epistemology is an emergent body of theory with some very apparent inconsistencies and issues of construct validity, yet there is potential for the further development of instruments and techniques to explore individual personal epistemologies and utilize findings to enhance and improve teaching and learning opportunities.

By addressing these issues, the research presented in this thesis can contribute to the development of new knowledge about this underdeveloped area of nurse education.

iv) Thesis Structure

The themes of personal epistemology and approaches to studying and their relationship to pre-registration nurse education are explored through eight chapters which encompass quantitative and qualitative research in a mixed methods design study:

- Chapter One contextualises this study, which is about student nurse learning in higher education. Current issues in nurse education are reviewed to provide the background to the study. A model of higher education is presented to provide a theoretical framework for the study.
- Chapter Two is a literature review which examines the model of personal epistemology used in this thesis; Schommer's (1990) Independent Beliefs Model. The appropriateness of this model for the basis of the study is justified by examining and critiquing later developments of the epistemological beliefs model in the light of contemporary literature. A theoretical framework of education drawing on personal epistemology and approaches to studying is presented.
- Chapter Three describes the methodological approach underpinning this study with justification for using quantitative and qualitative methods to explore the research questions. The results of a pilot study are presented, which was used to explore fundamental issues around the instrument design, administration and the underlying structure of the Epistemic Beliefs Inventory (Schraw *et al* 2002). Results from pilot interviews with students are presented, which were used to develop an interview schedule.
- Chapter Four is a description and analysis of the results from the quantitative study using a revised form of the Epistemic Beliefs Inventory, the full version of the Approaches and Study Skills Inventory for Students (ASSIST) (Tait *et al* 1997) and a short demographic questionnaire. The descriptive results from the survey and both exploratory and confirmatory factor analyses used to test the validity of the questionnaires are presented. Inferential analyses were used to explore differences in

different groups of students revealed by cluster analysis procedures. These provide insight into how personal epistemologies influence study approaches. Finally, a regression model demonstrates the effects of particular epistemological beliefs and approaches to studying.

- Chapter Five is an account of the findings from the grounded theory component of the study, including details of the coding, categorising and analysis of the interviews detailing how the substantive theory was constructed. The key findings demonstrate the effects of the students' social context on their approaches to studying and how they expressed conceptions of epistemological beliefs. The categories are described and presented graphically as a framework subsumed by the core category, which serves to contextualise the survey results.
- Chapter Six presents a discussion and synthesis of findings from the quantitative and qualitative studies and their relevance and meaning for nurse education. The constructivist grounded theory findings are used to contextualise and complement the survey through the use of a problematising process to ask questions of both datasets. This gives some insight into why particular study approaches are indicated by students and how their personal epistemologies influence studying from a wider viewpoint. Implications of the research for nurse education are considered and recommendations are made for education, clinical practice, research and policy.

Chapter One

The Educational Context for the Study

1.1 The Nurse Education Context for the Study

1.1.1 The Nurse Education Focus

The focus of the research questions addressed in this study was to further understanding of the characteristics of pre-registration nursing degree students personal epistemologies and their relationships to approaches to studying in a university setting. The context of this study is important because, arguably, nurse students differ in several significant ways to other students studying what could be classed as traditional university disciplines. In particular, it is known that nurse students appear to differ in their experience of stress when compared with other university students (Meachin & Webb 1996, Galbraith & Brown 2010). This is linked to both clinical experiences on placement and the academic demands of the course, particularly in mature students (Kevern & Webb 2004, O'Brien *et al* 2009). Whilst the research questions do not focus specifically on those factors, it is not unreasonable to presume nurse students could also approach learning and studying in different ways.

Before examining how personal epistemology is linked to student approaches to learning in greater depth, it is important to first consider the current context and purpose of pre-registration nurse education in the institution of universities within the UK. In considering this context, a brief examination of the socio-political influences that have effected, and continue to have an effect on the educational preparation of pre-registration nursing students is required.

1.1.2 The Purpose of Nurse Education

An intended aim of higher education in the preparation of nurses should be to provide opportunities for the student to reflect on their own approaches to learning and their attitudes and beliefs, which is congruent with the standards set by the Nursing and Midwifery Council (NMC 2010). These will be challenged by clinical practice and by changes in societal attitudes to knowledge, for example, trust in those who create knowledge. Thus, one of the roles of nurse education is to enable those students with the cognitive strategies to navigate those choppy waters and still make sense of the world around them. In nurse education and clinical practice in the United Kingdom, the wider socio-cultural context has been affected by persistent and stereotypical conceptions of the nurse (Darbyshire 2010). Additional factors include unstable and fluctuating political and educational influences on what form pre-registration nurse education should take, who it should be open to and where it should be situated.

The stated function of nurse education is to prepare students so they are fit for purpose, practice and award (UKCC 1999, NMC 2010). Guidance in the form of the previous NMC (2004) Standards of Proficiency for Pre-registration Nursing Education clearly stated that the academic level to which students should be prepared to obtain their award and entry to the NMC register should be at a minimum of a higher education diploma and professional nurse education must be 'academically rigorous' (p15). As well as standards of proficiency for practice, there are indicators for the fostering of cognitive thinking skills that education should seek to develop in students, which have clear implications for this study:

The level of learning must be such as to facilitate the achievement of knowledge, understanding and skill acquisition, and the development of critical thinking, problem-solving and reflective capacities essential to complex professional practice...

(NMC 2004, p17)

There are other indicators of the cognitive skills required of registrants in relation to evidence and knowledge:

...evidence should inform practice through the integration of relevant knowledge. (p23)

It includes searching the evidence base, analysing, critiquing and using research and other forms of evidence in practice, disseminating research findings and adapting practice where necessary. (p13)

Current NMC (2010) standards state nursing students should be academically trained to graduate level to provide the skills and attitudes required to weigh up evidence used to inform their knowledge base:

Students should become increasingly self-directed and independent, and able to make use of a variety of resources. (p9)

As graduates they must be able to think analytically, use problem- solving approaches and evidence in decision-making, keep up with technical advances and meet future expectations. (p4-5)

It must be evidence-based and reflect the very latest knowledge, practice, research and technical requirements. (p 8)

This is supported in Front Line Care (DH 2010) where it is stated degree education is the vision to support decision making on complex assessments and intervention in unpredictable and 'emotionally charged' situations and a degree should be a requirement for all leadership and clinical nurse specialists roles by 2020.

The ability to think analytically, to problem solve and make complex decision using best evidence are desirable qualities to be fostered in the resulting practitioners by nurse education. There is increasing international interest in the cognitive abilities, and more specifically the critical thinking skills, of both student and registered nurses in relation to patient safety (Fero *et al* 2009, Wangenstein *et al* 2010), diagnostic ability (Aquilino 1997) and the need for nurses to practice effectively in dynamic clinical environments (Simpson & Courtney 2002). Furthermore, this is recognized as an area where research into nurse education practice is required to make nurse educators more knowledgeable of

the importance of critical thinking skills and strategies to promote those skills in the classroom and curriculum (Profetto-McGrath 2003, Profetto-McGrath *et al* 2009).

1.1.3 Nurse Education and the University

Continual change has characterised the recent history of nurse education following an escalation in academic preparation from certificate to diploma and then to degree awards and every aspect of the minutiae of those changes has been critiqued in the literature (Draper 1995, Traynor & Rafferty 1998, Burke 2003). Burke (2003) has questioned the fundamental reasons for the move from traditional nursing schools into universities. One answer is that it was an accidental consequence of the creation of the internal healthcare market created by the Thatcher government, which did not include nurse education, in contrast to the move of other allied healthcare professions into higher education. An alternative interpretation of these events could be that it was to encourage more women into higher education (Bolger 1991). However, it was contended that higher education institutions would be more prepared accommodate vocational courses when it was realized the resources they would bring became apparent. Nurse students swelled the total number in higher education by approximately one-fifth (Mead & Moseley 2000).

Smith (1978) somewhat optimistically predicted a future where the professional standing of nurses and clinical practice would increase because of the entry into higher education. This occurred in the late 1980s with Project 2000 programmes, which aimed to produce the foundations for a 'knowledgeable doer'. The Project 2000 nurse was defined as a person who could amalgamate practical 'know-how' with academic knowledge to bridge the theory-practice gap, although academic and clinical perceptions of what that person should be still remain fluid and unstable (Drennan & Hyde 2009). The initial academic award for registrants was raised to diploma level and was then superceded by an expansion of graduate preparation following the Peach Report (UKCC 1999), which lead to the current situation of pre-registration nursing in Wales situated at degree entry and award level.

1.1.4 The Proper University Education

Criticism has followed the move of pre-registration education into the universities. For example, Watson and Thompson (2004) claimed student nurses are not provided with a 'proper university education' or a 'proper university experience' (p74). The proposed solution is for further education to take over the role as provider of non-graduate nurse education. What the 'proper' university education and experience should be is not elaborated upon and Watson and Thompson's (2004) rhetoric has elitist connotations. Indeed, there are several unacknowledged reasons for students not integrating with university life (Topping 2004). Many student nurses are classed as mature students, live at home and have to cope with studying whilst meeting family or caring responsibilities (Ofori 2002, Pryjmachuk *et al* 2009). Their way of being university students may not be regarded as the 'proper' way by some, but it is the only way these students can realistically access higher education. Arguably, what many student nurses actually want is to 'train' as nurses, to be competent in their practical nursing skills and the academic award is often secondary to this drive. However, this does not legitimise the argument forwarded by Watson and Thompson (2004) for moving nurse education out of universities. Increasing knowledge about student nurse learning behaviour is therefore more important if teaching interventions are to be successful and evidence-based.

The alternative viewpoint to that of Watson and Thompson (2004) is that instead of moving nursing programmes to further education, universities should wholeheartedly embrace nursing students as part of third mission objectives to widen participation, benefit local communities and diversify activities. Whilst this is worthy there is an inherent potential in this activity to create tensions or even hostility between scholarship and research activity in schools of professional education (HEFCW 2004, Watson & Thompson 2004). This has been manifest following the widening of the entry gate into nursing in the UK resulting in an intake of students with a diverse range of backgrounds, abilities and ethnicities into higher education (Ofori 2000). The longer term effects of widening access to degree courses in Wales remain to be seen and are a relevant issue now nursing has become a graduate-entry programme throughout the UK (NMC 2010).

This approach can be viewed as a move promoting inclusivity and equality, but widening access should be considered in the light of increasing student attrition rates and concerns about retention, common across many academic disciplines (Longden 2004, Prymachuk *et al* 2009, Urwin *et al* 2010). Furthermore, it has the potential to further increase the tensions between scholarship and research.

1.1.5 The Future of Nurse Education

The future form of nurse education re-assumed national importance following the 2007 Nursing and Midwifery Council Review of pre-registration nursing education that proposed a variety of potentially different futures for nurse preparation. Higher education would still play a pivotal role in the preparation of nursing students following the NMC Review, although anecdotal evidence suggests this might not include pre-registration nurses in all institutions. The conclusion of *Nursing: Towards 2015* (Longley *et al* 2007), which underpinned the NMC Review summarises the tensions facing future healthcare and provides a series of paradoxes for educationalists to consider. These appear to tacitly perpetuate established pervasive and powerful stereotypical images of nursing:

Demand for high technical competence ...AND... Continuing need for 'human' qualities and 'scientific rationality' in nurses and the time to express them

The public will expect nurses not to change ...AND... Nurses will demand new roles and responsibilities

(p73)

There are echoes here of the issues raised by Meerabeau's (2001) feminist sociological critique of the position of nursing within practice and academia, in which she discussed the rhetoric and language of criticism of nurse education, such as Sewell's (1999) 'bright girls' and the anti-intellectual bias in nursing presented by Rafferty (1996). There is a subtly implied resistance to creating a practitioner with both the practical or hands-on skills and a cognitive ability to critique knowledge, and thus manage and question

practice (and possibly authority). In these concluding paradoxes of the Review, the traditional tensions between caring and intellectual capabilities appear to be sustained, issues which are being heightened by the previously mentioned widening of entry gates into nursing courses (Ofori 2000).

1.1.6 Summary and Conclusion

These are the regulatory and professional considerations that nurse educators should take into account when formulating questions about how students perceive knowledge, how it is evaluated according to their internal belief systems, how it is acquired and how that knowledge is known at a fundamental level. The major characteristic of nurse education is that it is undergoing continual change and is subject to fluctuating forces both internally and externally exerting influence on the form and content of pre-registration programmes. The aims of nurse education are not necessarily congruent with those influences, and tensions exist between the needs of universities, the needs of clinical practice and mandates from regulators and professional bodies which present as a series of paradoxes (Taylor *et al* 2010). Ownership and production of knowledge is moving away from universities (Barnett 2000) and there is a possibility in future that this shift may affect pre-registration degree programmes, which could potentially regress to become pre-registration 'training' (Watson & Thompson 2004). Furthermore, professional bodies and government want nurses to be critical thinkers and problem solvers, but this is still hindered by persistent and insidious stereotypical images of the nurse that continue to haunt nursing (Derbyshire 2010). The registered nurse as the output of nurse education has been described as a 'test-bed and barometer of public opinion' with the 'product' scrutinised by the media and partly responsible for some of the ills of the NHS (Carr 2007).

Debatably, the direction that nurse education takes in the preparation of future nurses should not solely be dictated by professional bodies, but also by perceptions of the form of a future knowledge base for nursing and how it might facilitate new ways of working. A reshaping of the purpose of nursing and a break away from the dominance of a medical

model of ill health will require nurses who can operate in a field of shifting knowledge values (Antrobus 1997). Furthermore, it is likely future nurses will need to be able to solve unforeseen problems for which we cannot give the right answers at present. The one competitive skill will be the ability to learn (Papert 1998), which requires knowledge of oneself as a knower. Allied to this is the call for nurse education to produce graduates who have the potential to be future leaders, to be visionary and prepared to take risks (Taylor *et al* 2010). As previously stated, this concern with registrants' cognitive development and ability to appraise and use evidence is not just restricted to the UK, but is of international relevance and concern (Simpson & Courtney 2002, Fero *et al* 2008, Wangenstein *et al* 2010).

A robust evidence base providing justification for teaching interventions has been accruing, such as problem-solving teaching, which can promote critical thinking (Hattie 2010). Nurse educators must provide an evidence-based education and embrace the future to prepare nurses with the cognitive skills needed to cope in an ever-changing environment, whilst balancing this with the demands to produce nurses who are clinically competent (Taylor *et al* 2010). This makes this study of student nurse personal epistemologies and approaches to study relevant and timely because of the drive for pre-registration education to be at degree level and because of the international interest in developing cognitive skills for clinical practice. In the introduction to this section, differences between nurse students and other university students were outlined. Arguably, diverse influences have contributed to the current state of nurse education and the forms of programmes and their content. This outline of the context of nurse education is relevant to this study because it has a direct effect on the academic learning of nurse students in terms of level and location of study, and the issues arising from balancing different elements of programme design, particularly clinical placement experience.

1.2 The Higher Education Context of the Study

This research is concerned with pre-registration student nurses and how they learn in a higher education setting and, more specifically, the relationships between their personal epistemologies and approaches to studying. These areas can be regarded as subsets of student learning styles (Cassidy 2004), which will be explored in section 1.4 of this chapter. Prior to examining learning styles, it is important to briefly define learning and teaching because of the diverse range of meaning of these terms. The 'presage-process-product model' or '3-P' model of student learning (Prosser & Trigwell 1999) is presented as a means to conceptualise and examine links between different parts of the teaching and learning process.

1.2.1 A Definition of Learning

Learning is difficult to define and can have contrasting meanings dependent on viewpoint or discipline, for example if viewed from psychological or humanistic perspectives.

Learning is often defined in terms of product, a change in behaviour for example (Merriam & Caffarella 1999). However, it should be remembered learning can have a subjective emotional component as conveyed by Rogers (1983) when he describes learning as an insatiable curiosity, with an almost visceral element to the urgency involved in the need to know and discover new knowledge. This emotional component is an area that will be explored later in this study in relation to enjoying learning.

It is important to have an operational definition of learning for this study and Rogers (2003) defines two types of learning that occur in different contexts. Task-conscious (acquisition), or 'everyday', learning, is essential non-formal learning such as that which occurs during parenting, for example. This can be distinguished from learning-conscious or formalised learning (Rogers 2003), which is aimed at enhancing learning. This latter form of learning is obviously the most relevant to the research questions in this thesis and is contextually different from everyday learning because the individual is made aware that they are engaged in an activity that involves learning. However, it should be

recognised that both forms are important in nurse education because of the impact of clinical practice experience and socialization into the profession on students (Levett-Jones *et al* 2009). A more concise definition of formalised learning is that it;

...can be defined as a cognitive process of acquiring skill, knowledge, attitudes or the accumulation of habits of perceiving, thinking and acting.

(Education for Employment 2007)

This has resonance with the purpose of nurse education outlined earlier in this chapter (NMC 2010). Studying factors concerned with how student nurses go about their learning and acquire knowledge, skills, attitudes and habits of thinking is therefore a worthwhile area for higher education research. The following sections elaborate on the educational model that underpins this research.

1.3 Student Nurse Learning in Higher Education

1.3.1 Teaching in Higher Education

Nurse education in the United Kingdom is currently situated within universities and Prosser and Trigwell (1999) assert that higher education is ‘about creating contexts which make learning possible’ (p11). Within those contexts, it can be contended that a main component of effective learning involves the presentation of threshold concepts, or ‘troublesome knowledge’. The purpose of using threshold concepts in teaching is to present knowledge in a particular way with the intention that produces transformative, irreversible and integrative learning experiences (Meyer & Land 2003). The aim is to facilitate change in the perspective or preconceptions of the learner – examples of fundamental threshold concepts relevant to nursing could include conceptions of health, illness, caring and the so-called theory-practice gap (Cousins 2006, Atherton *et al* 2008).

It could be argued this approach to teaching is not new practice to challenge students, but might not be articulated using these terms. Of course, it should also be remembered that

many situations in clinical practice involve assisting people with coping with the paradoxes experienced during episodes of health and illness which will further challenge learners and provide learning opportunities that equate to threshold concepts (Antrobus 1997) and hopefully, these experiences can be harnessed through study activities.

If creating challenging learning contexts is accepted as the purpose of teaching and learning activity, then it is argued that teaching and learning are fundamentally related and the focus of teaching should be on the learning needs of students and how they can be met (Prosser & Trigwell 1999). This is a fundamental basis for pursuing the research questions about learning styles and personal epistemology.

1.3.2 The Role of Teaching in Higher Education

The role of teaching in higher education is, firstly, to develop a coherent and articulate overall view and plan of what is trying to be achieved and, secondly, to explore the variation in student perceptions of that planned learning view and its context (Prosser & Trigwell 1999). This strongly implies teaching and learning activity requires careful design to promote engagement with students. Finally, university teachers should work toward integrating awareness of their articulated view with student perceptions of it and endeavour to develop a relationship where students can engage with those views (Prosser & Trigwell 1999).

Understanding how student perceptions of learning might interact in relation to the teaching and learning context can be facilitated by the 'presage-process-product model' or '3-P' model (Prosser & Trigwell 1999) derived from Biggs (1978) presented in figure 1.1. This model breaks down the teaching and learning process into the interactions between components of student learning with an initial flow from left to right, with presage factors influencing the learning experience and outcomes.

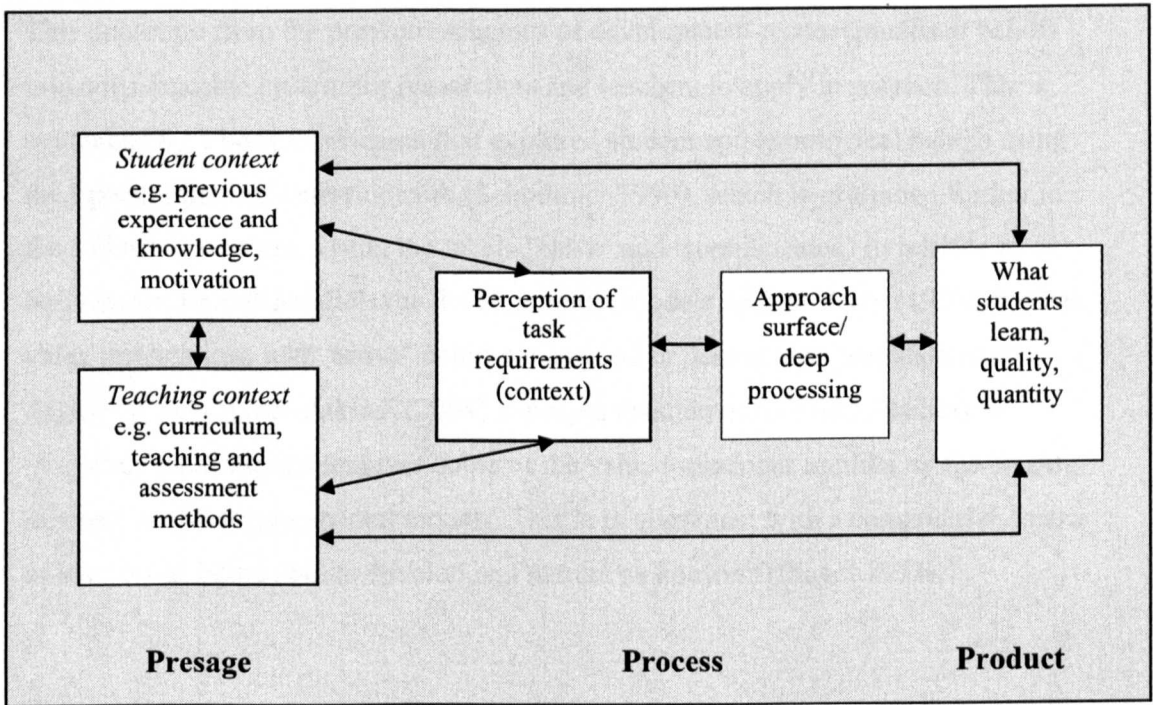


Figure 1.1: Presage-process-product model of student learning (Prosser and Trigwell 1999).

The model should be considered as a heuristic device to aid analysis in the complex reality of teaching and learning interactions (Prosser & Trigwell 1999). However, the real value lies in that it is not solely a student deficit-oriented, nor a teaching-oriented model. Rather, because it has recursive links between the components, it can be regarded as representing a system in equilibrium and changes in one component may be absorbed by the others. These changes may only go so far, however, and drastic changes in any could cause the entire system to lose equilibrium and fail, or result in the creation of a new system (Biggs 1994). Thus, the model provides prompts for consideration with regard to the teaching side of the model and how they might affect the student outcome.

The 3-P model integrates various components of teaching and learning into a process-based system that can provide a framework for teachers to understand practice. However, Biggs (1994), adopting the words of Schön (1987), provides a warning to those (of us) sitting up on 'the hill' and looking down onto the world we study in our attempt to describe the systems we view, which in reality should be regarded as:

...a soft, slimy swamp of real-life problems to which adding or subtracting things will either have to measurable effect, or worse, will destroy the swamp's eco-system. (p3)

In addition, Coffield *et al* (2004) remind us in their systematic review of learning styles, beneath the shiny appeal of educational research lie a multitude of conceptual and empirical problems. The next sections will attempt to untangle a few of these.

1.4 Learning Styles

As previously stated, personal epistemology and approaches to studying can be regarded as aspects of, or influences on learning styles. These are an appealing, but potentially complex and conceptually confusing area of educational research because of the extensive body of literature from a wide range of disciplines and perspectives (Coffield *et al* 2004). However, to make this area more manageable, learning styles can be broken down into three key components (Cassidy 2004):

- Cognitive style;
- Information processing;
- Teaching preferences and learning strategies.

Disagreement over definitions of these elements of styles remains a concern (Peterson *et al* 2007). The research questions in this study are primarily focused on cognitive style and information processing, but preferences for teaching are a component of the investigation into approaches to studying.

1.4.1 Cognitive Styles

Cognitive styles are defined as individuals' preferred modes of thinking, perceiving, problem-solving and remembering (Messick 1984) and can be regarded as consistent traits which may not be easily modified (Riding & Cheema 1991). The connection between personal epistemology and cognitive styles is provided by Sternberg and Grigorenko (1997) who regard cognitive styles as a bridge between two areas of psychological investigation, cognition and personality. Curry's (1987) onion model (figure 1.2) provides a pragmatic taxonomy with which to conceptualise the relationships between cognitive and other learning styles.

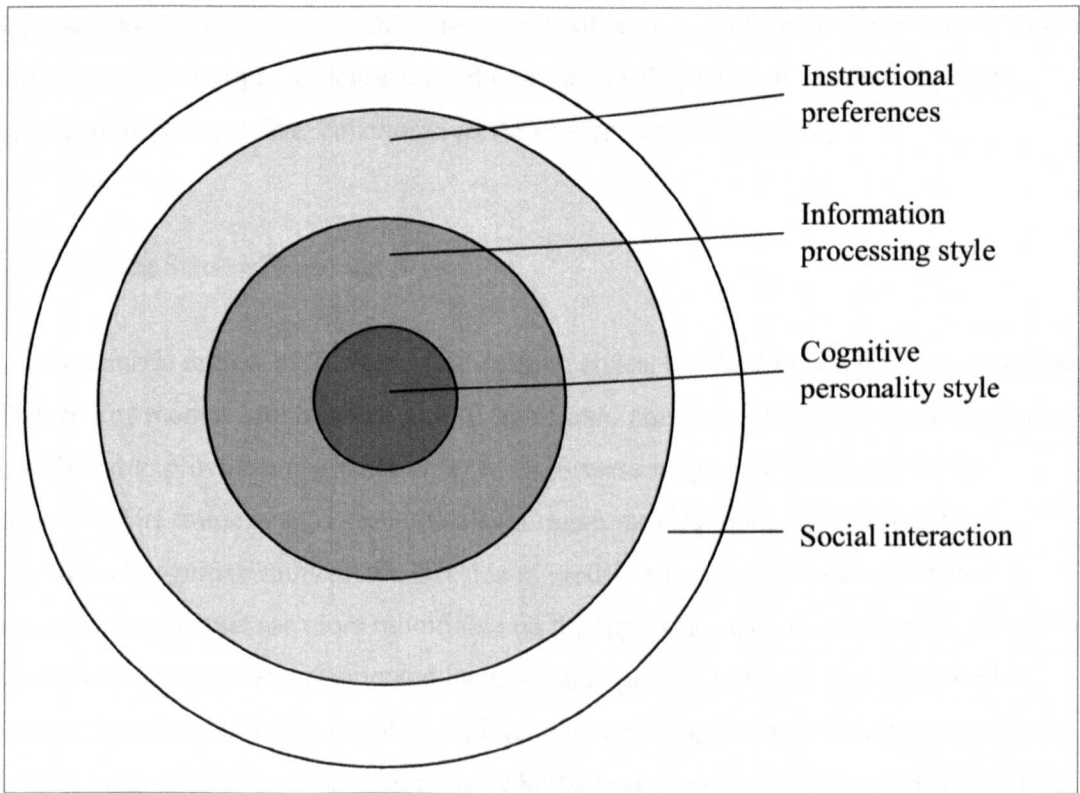


Figure 1.2: Curry's onion model of learning styles (after Curry 1987).

1.4.2 Learning Strategies

Learning styles are the application of cognitive styles, that is, the way an individual approaches problem solving, thinking and remembering in a learning situation (Riding & Cheema 1991). Learning strategy is an additional term used in the literature and is differentiated from learning styles by being the preferred approach taken by students when studying. Learning strategy may be regarded as being more consciously decided than the more subconscious, or 'automatic', learning styles (Hartley 1998) and furthermore, may be environmentally dependent (Peterson *et al* 2009) and directed by curriculum elements, particularly learner assessment and feedback. Because of the effects of context, learning strategies can be regarded as malleable (Peterson *et al* 2009). This layer is the focus of the approaches to studying questionnaire (Tait *et al* 1998). Finally, the outer layer is concerned with social aspects of learning or how students interact in the classroom, for example, Reichmann and Grasha's (1974) types of learners (avoidant, participative, competitive, collaborative, dependent and independent).

1.4.3 Making Sense of Learning Styles

In a systematic review of 71 models of learning styles, Coffield *et al* (2004) re-organised thirteen key models into a framework of 'families'. This was intended to build on Curry (1987) and to provide a degree of order to the diverse range of styles extant in the literature. The framework is based on a continuum moving from more or less fixed genetic and cognitive traits on the left side to models based on self and experience including factors that are more modifiable on the right side, such as motivation, influence of curricula and assessment-oriented learning strategies (figure 1.3). It is included here because Entwistle's (1990) model is highlighted on the right, which was the basis for the development of the Approaches and Study Skills Inventory for Students (ASSIST) (Tait *et al* 1998) used in this study.

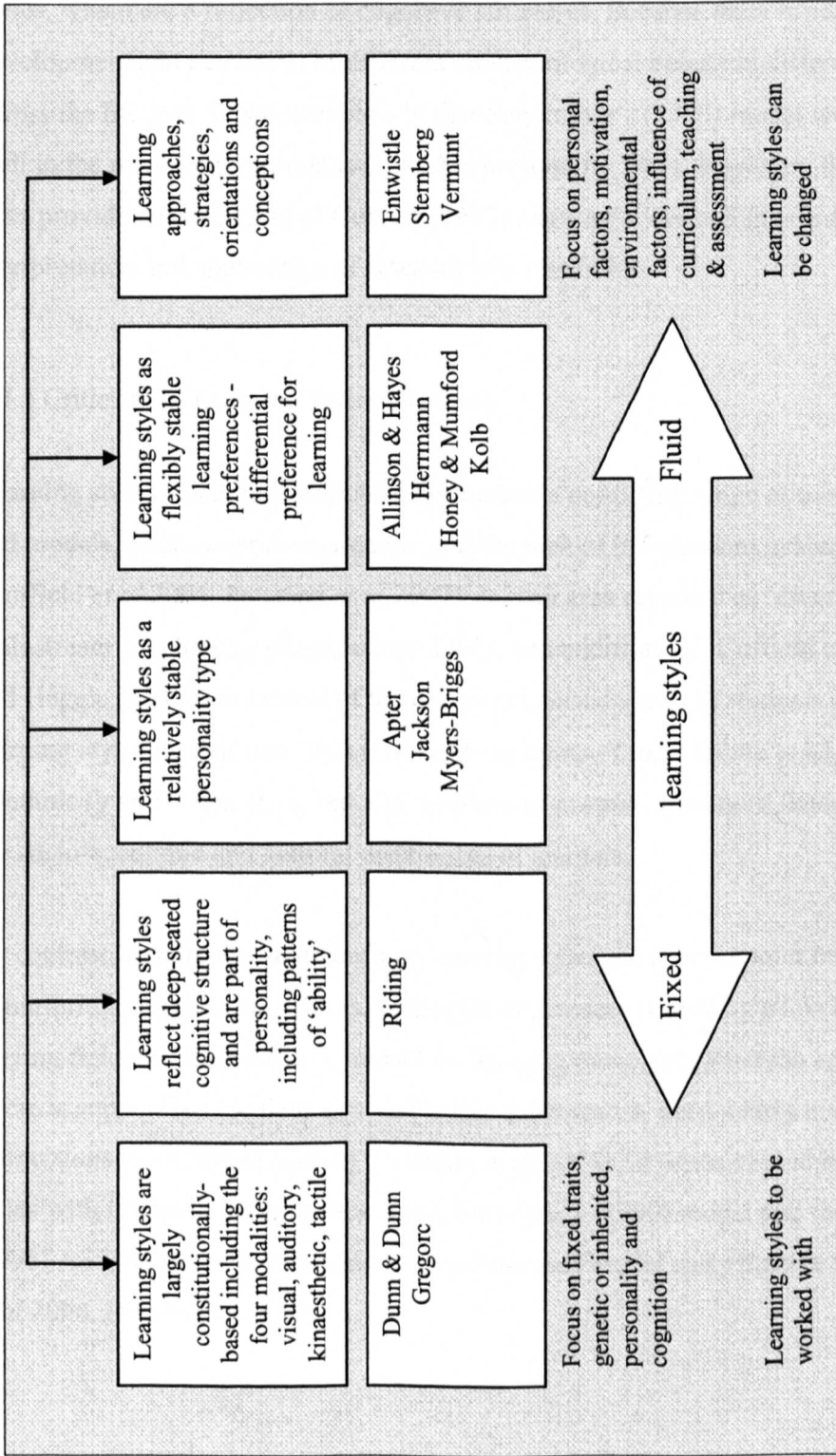


Figure 1.3: Families of learning styles based on the systematic review in Coffield *et al* (2004)

Schommer's (1990) model of personal epistemology is not a member of the families in the framework, but it could sit as an influence on the second family of learning styles, which are a reflection of cognitive structures. Because there is potential for development and activation of different epistemological beliefs in different contexts across the lifespan, it is debatable whether Schommer's (1990) model would not fit well in the next family of relatively stable personality types. However, the framework does provide an expansion of Curry's (1987) learning styles and thus aids interpretation and application of research into this field.

1.4.4 Criticism of Learning Styles Research

Learning styles research is criticised because of a confusing range of overlapping tests and models, issues over measurement and the lack of independent evaluation (Coffield *et al* 2004, Peterson *et al* 2007). It is an area regarded as 'divorced' from mainstream psychology (Kozhenikov 2007), and additionally, Coffield *et al* (2004) and Haggis (2003) are critical of the decontextualised views of students provided by learning styles inventories. This is not only in terms of their failure to address issues of ethnicity and social class, but also a failure to examine at a more fundamental level the socio-economic and cultural differences in learners.

By contrast, researchers in defence of learning styles are keen to point out the benefits of nurturing potential in students, with style differences providing a levelling of the playing field and their positive impact on learning outcomes (Peterson *et al* 2007). There is support for the field as a viable line for research, particularly in developing connections to cognitive science (Peterson *et al* 2007). In terms of studying learning styles with regard to learning strategies, Entwistle's (1990) model and the Tait *et al* (1998) ASSIST are recommended as an established model and effective tool (Coffield *et al* 2004, Peterson *et al* 2007).

1.5 Relevance of Learning Styles to Nurse Education

The study of learning styles is relevant today in the context of nurse education despite the criticism regarding research into this field and the potential for reductionist views of student learning it might promote. There is a need to examine aspects of student nurse social lives and their influence on learning and these appear to have been generally ignored in the learning styles literature and inventories (Coffield *et al* 2004, Mansouri *et al* 2006). The widened entry gate into higher education is likely to result in pre-registration nurse students having a more diverse range of educational and employment backgrounds, abilities and needs than before (Ofori 2002). We know in particular that mature students often have demands that affect their academic learning (Kevern & Webb 2004), but there are gaps in our knowledge about how these demands affect learning styles.

1.6 Chapter Summary

This study is concerned with student nurse learning in higher education and this chapter has established the context in which the research is situated. This has been presented in terms of defining the purpose of nurse education in the UK, which has a bearing on the level and type of learning expected of student nurses. Knowledge of influences on the student learning context and the processes that inform approaches to studying can be used to influence and enhance student outcomes. Student nurses are different to other higher education students because of the demands of the preregistration programme. Therefore, research into their learning approaches is warranted. Relationships between learning styles and personal epistemology are explored in greater depth in chapter two.

Chapter Two

Personal Epistemology and Student Approaches to Learning: A Literature Review

2.1 Introduction

The purpose of this chapter is to explore the key themes of personal epistemology in the existing published literature and to lay the path for the origins and development of the study's research questions. As stated in the introduction, personal epistemology is situated within the discipline of educational psychology, thus it is important to establish relationships with nurse education and higher education theory and practice. Through critique of the conceptual basis and current developments in models of personal epistemology in this chapter and their relationships to learning styles, personal epistemology will be defined for the purpose of this research.

2.2 Personal Epistemology

2.2.1 Definitions of Personal Epistemology

It has been established that epistemology is an ancient and fundamental area of philosophy concerned with the study of questions about the nature of knowledge, how knowledge is acquired and how people know. More specifically, epistemology is concerned with the origin of knowledge and the role of experience and reason in creating knowledge. Epistemology also raises questions about the relationships between knowledge, certainty, scepticism and the changing forms of knowledge arising from new views of the world (Blackburn 1996). By contrast, personal epistemology focuses on empirically investigating how the individual perceives knowledge and knowing. Personal epistemology can be succinctly defined as;

...systems of personal or implicit beliefs about the nature of knowledge and learning as a context or set of assumptions within which their learning and thinking take place.

(Paulsen & Wells 1998, p365)

There is an indication here that beliefs about knowledge exist as 'systems' implying the possibility that there are multiple beliefs and they are organized in conceptually definable ways. Furthermore, learning is a component of this definition and emphasises the inter-relatedness of these two different concepts. There is also the idea of context in this definition, presented alternately as 'a set of assumptions'; not only is the learning environment a physical place, but it is a context of teaching practice in school or university, co-constructed between the student and teacher.

Hofer (2004b) defined personal epistemology as;

...what individuals believe about how knowing occurs, what counts as knowledge and where it resides and how knowledge is constructed and evaluated.

(p1)

This is a more dynamic view, which does not imply belief systems exist solely as static entities and is potentially more student-centred than Paulsen and Wells (1998). There is an implication of action on the part of the learner by expanding the issue of the axiological value of knowledge, and of how the learner perceives where, or possibly who, knowledge comes from (where it resides). Furthermore, there is a value statement because it can be regarded as student-centred with the focus on the individual, thus making the definition suitable for educational contexts.

Hofer (2004c) built on this definition with the addition of the elements of metacognition and the consideration of contextual factors including culture, academic discipline (domain specificity) and environment, suggesting personal epistemology is;

...a set of beliefs, organized into theories, operating at the metacognitive level. Such theories develop in interaction with the environment, are influenced by culture and education and other context variables, operate at both the domain-general and domain-specific level, are situated in practice, and are activated in context.

(p46)

This definition further formalizes the idea of belief systems by proposing they exist as 'theories' which suggests they exist with form and organization. It is arguable whether the claim the beliefs are organized into theories is sustainable, but the definition does expand on Hofer (2004b). Here, there is an important development in the contention by Hofer (2004b) that these belief systems are domain, or discipline, specific and general simultaneously, that is, there may be general and specific epistemological beliefs, for example, differing beliefs about the value of knowledge in mathematics or sociology. Furthermore, this raises the issue that context is important in 'activating' those beliefs, suggesting teachers could potentially employ or monitor them in learning activities or deliberately target beliefs as part of a teaching strategy. In addition, there is a stated relationship with metacognition, which is explored further in section 2.4.

Schommer-Aikins (2004) regards the properties of epistemological beliefs as 'subtle, yet ubiquitous' (p27) affecting both student and teacher. As a definition, it is thought-provoking, but not necessarily useful, particularly when her research approach includes questionnaire instruments and powerful quantitative and statistical methods to set tight boundaries around what are defined as independent belief systems (Schommer 1990). 'Subtle, yet ubiquitous' implies a more fluid definition of epistemological beliefs congruent with qualitative approaches to explore them. Each independent belief in the system can be visualized or characterized as a frequency distribution, rather than as a point on a continuum (Schommer 1994), suggesting they are dynamic and variable rather than static scores on a scale (examined further in section 2.7).

By way of contrast, in reaction to Schommer's (1990) Independent Belief System model and the developmental model school, Hammer and Elby (2002) challenge the 'established' conventions of personal epistemology by viewing the cognitive elements of personal epistemologies as being of a much finer 'grain size' in their words (p170). These units of cognitive structure act as resources for understanding knowledge in its differing forms, rather than areas where students have deficits. The model is under development and there is little research using this model, but the idea of personal epistemology as epistemological resources is useful to critique other models. The co-constructed nature of these resources could be a potentially promising and productive

way of regarding relationships between student and teacher beliefs about knowledge in practice.

Finally, any attempt to understand student personal epistemology has implications for those involved and may raise difficult and awkward questions about, and prompt reflection on their own personal epistemological make-up. In a critique of one framework of student development, *Types of Knowing* (Baxter Magolda 1992), Welte (1997) summarized somewhat naïve opinions about the challenges facing those interested in pursuing research into personal epistemologies and the possible issues posed by the confronting personal teaching establishment:

Identifying and understanding our assumptions is a challenging task in itself. The goal of *changing* these assumptions is truly daunting...many teachers and students do not want to change these underlying assumptions. They do not see knowledge as being socially constructed, and they certainly do not see the student as a knower...they view knowledge as defined and objective; it is the job of the teacher to transmit this knowledge to the unknowing students...the teacher has the knowledge, the students want it; and the teacher deposits the knowledge into the students' heads in a concrete and measurable transaction.

(p212)

This viewpoint could act as a deterrent to potential researchers and presents students in a negative light. Arguably though, teachers who are passionate about teaching and knowing about student learning have strategies to cope with these perceptions. In this instance, 'changing assumptions' is possibly a naïve and unrealistic expectation of teachers and education. However, Welte (1997) does raise a valid question about what should be done about student epistemologies as they become known.

It will be seen as this chapter develops that there are alternative stances to Welte's (1997) view. Accessing student beliefs and enabling students to reflect on those beliefs may well be a more appropriate aim than to suppose that they can be changed in some way by the system (Schommer 1993b). In terms of training or preparing student nurses for a professional role and career, knowledge of personal epistemologies could be an important component in building self-awareness. This awareness could be developed in conjunction with tools such as reflection, although the relationship between the notions of self, self-awareness and education is still an area requiring critical examination (Cook 2001).

In summary, personal epistemology research is concerned with:

- How individuals' think and is focused on beliefs about knowledge and knowing.
- The effects of learning and education on learning.
- How an individual constructs and evaluates knowledge and how those beliefs are activated in context.

The next section focuses on the core elements that have been proposed to make up epistemological beliefs and their relevance to a nurse education perspective.

2.2.2 Core Questions in Personal Epistemology Research

The central research questions in the field of personal epistemology are those about how these beliefs could affect motivation, cognition and academic performance. This is known as the 'beliefs-affect-learning hypothesis' (Mayer 2003). There is also interest in whether teaching activities might result in changes in epistemological beliefs, or 'the learning-affect-beliefs hypothesis' (Mayer 2003). Insights from research studies since the seminal work of Perry (1970) on the ethical and intellectual development of students have been congruent in their recommendations for further research. Exploration is needed about how the context of learning, or the learning environment, might affect student development of more sophisticated reasoning and mature beliefs about knowledge (Hofer 1999). Alongside these concerns, interest has developed into how these beliefs might interoperate with approaches to studying and motivation (Paulsen & Feldman 2005, Cano 2005, Bråten & Olaussen 2005).

However, the breadth of models of personal epistemological beliefs and their investigation from a range of ontological viewpoints is potentially confusing and masks disagreement in the field about the nature of the phenomena (Niessen 2007, Greene *et al* 2008). However, there is agreement at a fundamental level that beliefs about knowledge are personal cognitive constructs which are not explicitly expressed and, therefore, this level of abstraction and methods of investigation makes these beliefs difficult to define and analyse. To use a worn analogy, investigating these

beliefs is like asking golfers how they swing their club when they are in the bar after the match (Hammer & Elby 2002).

As a result, there is the current situation where a diverse range of models have arisen as a result of differing research paradigms and methodologies. In terms of education, the study of interventions which assist belief change, modification or, more recently, belief activation, are proposed to be an essential line of enquiry (Schraw 2001, Louca *et al* 2004). However, this will need firmer and more defined construct definitions, improved models, not necessarily derived solely from quantitative analyses and a greater level of agreement over how these belief systems operate (Muis *et al* 2006, Greene *et al* 2008).

2.2.3 Current Perspectives and Scope of Personal Epistemology Research

Current perspectives on personal epistemology focus on the study of systems of beliefs about knowledge with regard to what knowledge is perceived to be, where it is situated and how it is constructed. Epistemological belief systems are implicit personal cognitive constructs (Hofer 2001) that may be influenced by culture (Hofer 2008), context and domain or discipline (Muis & Bendixen 2006) and may be accessed or activated by teaching and learning strategies (Hammer & Elby 2002). These systems are in turn distinct from attitudes and intentions (Fishbein & Ajzen 1975), but may in turn, inform or underpin them.

Personal epistemology research can be organised into three broad areas:

- Developmental perspectives of personal epistemologies as systems where individuals move along pre-determined trajectories from 'naïve' or dualist to more sophisticated positions: Perry (1970), Belenky *et al* (1986), Kuhn (1991), Baxter Magolda (1992), King and Kitchener (1994), Greene *et al* (2008).
- Personal epistemologies as systems of cognitive beliefs that can develop and mature independently of each other: Schommer (1990), Schommer-Aikins (2004), Qian and Alvermann (1995), Kardash and Scholes (1996), Hofer (2000).

- Contextually activated and constructed epistemological resources: Hammer and Elby (2002), Louca *et al* (2004), Niessen (2007).

All three perspectives are important to this research because teaching and learning experiences prior to this study offered glimpses of elements of these models in the students' behaviour during their learning activities. Because of the somewhat abstract nature of the core concepts of personal epistemology, key terms will be defined and summarised in the following sections.

2.3 Epistemology and Belief

Before examining the model of personal epistemology used in this study, the terms epistemology, belief and attitude are considered. Definitions are needed because belief and attitude are often used interchangeably in conjunction with values in the same sentence or context. The concept of belief about knowledge is one open to multiple interpretations which have been dependent on researchers ontological viewpoints. Therefore, it is worthwhile examining conceptions of belief in order to define and situate the concept in the context of this research.

2.3.1 Epistemology, Belief and Knowledge

Personal epistemology is a branch of educational psychology derived from epistemology, which arose from the dialogues of Greek philosophers such as Plato's *Meno* from 400 BC (Hofer 2004a). This Socratic dialogue is concerned with how to distinguish true belief, or opinion, from fuller knowledge and understanding, or *justified* true belief, in order to provide a basis for a theory of knowledge (Klein 1965). An epistemological belief can be false or based on insufficient evidence, but what knowledge actually is and how it can be known with certainty has since been of fundamental interest to philosophers. Commitment to belief, albeit fallible, is also central to holding those justified true beliefs when knowledge is constructed and validated about a new situation or phenomenon.

The type or form of knowledge in question is an important consideration.

Epistemology is generally concerned with propositional knowledge and in particular, 'knowing that' (justified true belief) rather than 'knowing how', although the latter is a major focus of nursing knowledge (Drennan & Hyde 2009). Arguably 'knowing how' is built upon propositional knowledge or empirical knowing. Personal knowledge acquired from experience, such as that advocated by Polanyi (1998) is seen as important to nursing practice and is a major component of Carper's (1978) patterns, which will be discussed further in 2.14. In the context of this study, a strictly defined line is not drawn between propositional or performative knowledge because the two are so tightly entwined.

Established personal epistemology research is concerned with beliefs about knowledge that may be portrayed as dualistic or dichotomous, 'right and wrong' in the more 'naïve' positions (Perry 1970) or less activated belief systems (Schommer 1990). The use of the term 'naïve' which is common in the literature in relation to epistemological beliefs is discussed later, because arguably it is value-laden. As the systems develop or an individual moves along a trajectory, the beliefs become more complex and relativistic and may be regarded as co-constructed and enactivist (Hammer & Elby 2002, Niessen 2007).

2.3.2 Beliefs, Attitudes and Values

In psychological terms, beliefs are regarded as fundamental cognitive structures that represent what we know about the world (Gross 2001). These may be inaccurate, incomplete or non-evaluative, but not as strongly held as knowledge (Colman 2006). However, the differences between the processes of believing and understanding are not so clear and remain open to interpretation. What is relevant here is that cognitive processes are thought to cause the mind to believe more readily and accept, rather than reject, ideas during what is considered to be the non-voluntary process of comprehension (Gilbert 1991).

In relation to attitudes Fishbein and Ajzen (1975) explain from the viewpoint of social psychology that 'a belief links an object to some attribute' that is, information such as

characteristics or qualities of that object. Ajzen (2001) defines attitude as ‘a summary evaluation of a psychological object’ and the evaluative judgment is such a fundamental cognitive response it could be regarded as a need. However, Olson and Zanna (1993) point out there is no central definition of attitude accepted by all theorists and provide alternatives based around affect, cognition – ‘a special type of knowledge, of which content is evaluative or affective’ and behaviour – ‘a state of a person that predisposes a favourable or unfavourable response to an object person or idea’. Values are defined as the means to convert a belief into an attitude, thus an individual might possess many beliefs, fewer attitudes and a handful of values, such as wisdom, equality and competence, which are states to be attained, ‘wisdom’, or attributes that become means of attaining those states, ‘competence’ (Gross 2001).

A distinction is drawn between belief and attitude, an attitude being to a person’s favourable or unfavourable evaluation of the object, or, in other words, the value attached to it. As with belief systems, attitudes do not exist solely in a static, or bipolar, ‘one object, one attitude’ state but Ajzen (2001) suggests there appears to be a more dynamic existence, and an individual may hold multiple attitudes in relation to the same psychological object. In order to elicit an explicit response rather than one that is implicit and evaluative, Ajzen (2001) suggests requires motivation and capacity, and diverse responses may be the result of evaluations of the same object in different contexts. It is posited that these multiple attitudes and their dependence on differing contexts might explain why there are differences between attitudes and behaviour.

2.3.3 Beliefs, Attitudes and Personal Epistemology

In terms of personal epistemology, beliefs about knowledge are regarded as deep-seated rather than attitudes and in terms of links to an attribute, are probably not something one would normally consciously think about or express. It is possible to draw connections between the constructions of belief, attitude and value and the models of personal epistemology which have evolved and diversified from fundamentally linear developmental schemes to more complex multi-dimensional models dependent on context and stimuli. Whilst it would be possible to possess

certain attitudes about different forms of knowledge, it is not clear how beliefs could be distinguished from attitudes and how they might be evidenced in practice. Thus, a central question in personal epistemology research is how can epistemological beliefs be defined and in relation to this study, how they might influence studying, or how students approach learning.

2.4 Core Components of Epistemological Beliefs

Hofer and Pintrich (1997) and Limón (2006) have proposed that models of personal epistemology share similar core components or units of cognitive structure. These are fundamentally concerned with the nature of knowledge ('what knowledge is') and the nature of knowing ('how you come to know') when components concerned with the educational experience or to learning and motivation (e.g. Schommer's quick learning) are stripped away.

The nature of knowledge is sub-divided into the dimensions of certainty of knowledge and simplicity of knowledge. Hofer and Pintrich (1997) claimed these core beliefs form the basis of an individual's epistemological theories organized in an orthogonal manner and they have a coherent and comprehensive structure. The nature, or process of knowing, is proposed to have two dimensions; the *source* of knowledge and the *justification* for knowing. These dimensions are further explained here as they have been the focus of empirical development by Schommer (1990), Belenky *et al* (1986), Baxter Magolda (1992) and King and Kitchener (1994) onwards:

Nature of knowledge

- *Certainty of knowledge* – understanding moves along a trajectory from an absolute or simplistic view to one increasingly relativistic or sophisticated (certain vs. tentative knowledge), where theories may be developed and openness to change and reflection are key components of practice (Schommer 1990).

- *Simplicity of knowledge* – ideas move from knowledge as absolute truth or factual data to a more fluid view where knowledge becomes relative and contextual (simple vs. complex knowing) (Schommer 1990).

Nature of knowing

- *Source of knowledge* – development begins with the individual viewing knowledge as separate from and outside of the self and it is received from an external authority, which can have engendered associations, whose role is to transmit or hand over knowledge.

Change in this belief is regarded as a key developmental point. There is development into a knower, when knowledge becomes part of the self, at which point an individual can interact and make meaning with others and their environment. The relationship with others changes as does the position of authority in relation to the learner or knower (omniscient vs. personal construction) (Belenky *et al* 1986, Baxter Magolda 1992, Schommer 1990, Schraw *et al* 2002).

- *Justification for knowing* – is concerned with how knowledge and evidence are evaluated, with progression from a dualistic system to acceptance of multiple opinions, viewpoints and sources or ontology's. This can include integration and evaluation of expert opinion or evidence (King & Kitchener 1994).

These four components, often referred to as dimensions, provide a conceptual basis for models of personal epistemology and for studying learner metacognition, or reflection on thinking, which can be defined as ‘..thinking about your thinking while you’re thinking in order to make your thinking better’ (Paul & Binker 1995). This is relevant to nurse education where reflection on and in practice is seen as an essential element of professional practice (Riley *et al* 2008) and is a metacognitive process focused on one’s own experiences (Mezirow 1981). Exploring the links between personal epistemology and metacognition is outside the scope of this research and is an area now assuming greater interest and importance as a research stream (Bromme *et al* 2010, Hofer & Sinatra 2010).

Critical thinking, or cognition, has been defined as a rational-linear problem solving process (Jones & Brown 1991). However, this is disputed by Simpson and Courtney (2002) and Fero *et al* (2009) because the purpose of critical thinking may not be to seek answers, but to generate questions about the situation or context and to be instrumental in generating solutions. In the context of advanced nursing practice, it is argued that critical thinking in nursing is different to other disciplines (Distler 2006) and can be defined as:

Critical thinking in nursing is an essential component of professional accountability and quality nursing care. Critical thinkers in nursing exhibit these habits of the mind: Confidence, contextual perspective, creativity, flexibility, inquisitiveness, intellectual integrity, intuition, open-mindedness, perseverance, and reflection. Critical thinkers in nursing practice the cognitive skills of analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting and transforming knowledge.

(Fesler-Birch 2005 p60)

All of these elements are seen as essential to modern nursing curricula and professional regulation (UKCC 1999). The critical thinker can be characterized by being well-informed, open-minded, aware of personal biases, a seeker of relevant information, focused and persistent in inquiry (Facione 1990), which Wangenstein *et al* (2010) consider to be representative of the ideal nurse. To achieve this it is contended knowledge of one's own personal epistemology is an essential component.

To summarise, the study of personal epistemology, particularly in a discipline where ill-structured problems are common in practice (Aquilino 1997) is of value to nurse educationalists as a means of identifying and facilitating the promotion of metacognitive thought in students. Furthermore, there is value in the study of teachers themselves (Schraw & Olafson 2003) and their role in improving teaching and learning experiences through identification of strategies, challenges and support conducive to improvement of both academic and possibly clinical performance. Reference to clinical practice is made because it is plausible in future that links will be made between personal epistemology and how knowledge is critiqued, integrated and utilized in practice, that is, informing us how evidence might be evaluated and employed by nurses.

2.5 Personal Epistemology, Models and Semantics

2.5.1 Diversity in Model Terminology

It becomes apparent on initial acquaintance with personal epistemology research that there are a diverse range of titles and terms used to describe and explain personal epistemology 'theories' and conceptual models and not all personal epistemology research is labelled as such (Limón 2006, Niessen 2007). Table 2.1 provides a summary of the main models organized according to typology and their key characteristics coincide with their developmental chronology. There are three main groups of models differentiated primarily the methodological paradigm that informed the research from which they were derived. Also, there is not complete agreement as to whether the beliefs should be termed epistemological or epistemic (Mason & Bromme 2010). In this study epistemological beliefs will be the terminology used in line with current custom and practice in the research literature, although the title of the instrument used in this research is the Epistemic Beliefs Inventory (Schraw *et al* 2002).

2.5.2 Definitions of Model and Theory

'Model', 'framework' and 'theory' are often used loosely and interchangeably in personal epistemology research (and that of learning styles outlined in chapter one), which results in blurring of the meaning of these terms. More precise definition of the meaning of model and theory is relevant because personal epistemology is a continually developing field which shares units of analysis with other areas of the disciplines of education and psychology. For clarification, 'model' is used describe a phenomena or process, whereas a 'theory' may be concerned with a range of issues, general organizing principles and may unify models (Fawcett 2005). Ideally, theories can describe, explain, predict, prescribe or control, but in reality, this may be almost impossible to achieve, or would be morally or ethically undesirable.

Models enable the elements of a theory to be depicted graphically, either symbolically, such as using an equation, or schematically as a diagram. The diagrammatic type of model acts as an heuristic device to aid understanding of

components of the theory (Fawcett 2005), defined as ‘an internally consistent group of relational statements (concepts, definitions and propositions) that present a systematic view about phenomenon’ (Walker & Avant 2005, p28). Fawcett (2005) regards these characteristics indicative of middle-range theory. In terms of knowledge in nurse education, research and practice, distinction grand theory and mid-range theory are generally distinguished depending on the purpose of the work. Personal epistemology currently has an overarching set of concepts which partially fit the criteria required of a middle-range theory and there are a range of ontologically different models. These will be briefly examined and evaluated in the next section to establish the justification for selecting the Independent Belief Systems model (Schommer 1990) as the underpinning theoretical framework used in this research.

2.6 Overview of Models of Personal Epistemology

Despite differences in the terminology of inquiry and model development, personal epistemology research has the common thread of an interest in student thinking and beliefs about knowledge, knowledge construction and evaluation and the ‘how’ of knowing. The models can be separated reasonably straightforwardly into three different types, developmental, belief systems and epistemological resources models (identified by different shading). Key features are summarised in table 2.1 to emphasise their strengths and limitations. These models of personal epistemology were identified as key developments by reviews of the state of the field and have arisen almost exclusively from educational psychology (Hofer & Pintrich, 1997, Limón 2007):

- Forms of Intellectual Development (Perry 1970)
- Women’s Ways of Knowing (Belenky et al 1986)
- Epistemological Reflection Model (Baxter Magolda 1992)
- Reflective Judgement model (King & Kitchener 1994)
- Theory of Argumentative Reasoning (Kuhn 1991)
- Epistemological Belief Systems model (Schommer 1990 and 2004)

In addition those reviewed by Hofer and Pintrich (1997), Hammer and Elby's (2002) epistemological resources and Niessen's (2007) more recent enactivist epistemology models are included in the table for comparison. Hammer and Elby's (2002) model is notable because it has arisen from the discipline of physics and education and the researchers do not present themselves as educational psychologists.

The Epistemological Beliefs System model (Schommer 1990) is positioned as a successor to the developmental models and a predecessor to the more reactionary, and arguably less tested, epistemological resources lines of enquiry. The developmental models are all derivatives of Perry (1970), whereas Schommer (1990) sought to reconceptualise the field from a quantitative and multidimensional perspective. However, this model encompassed building blocks from previous research which will be discussed in detail in section 2.7.

Table 2.1 serves to demonstrate how the different models are situated both chronologically and conceptually within the field of personal epistemology research. The grey shading indicates developmental models, turquoise, independent beliefs systems and green, epistemological resource models.

Table 2.1: Terminology and characteristics of key models of personal epistemology.

Title of model	Model typology	Authors	Strengths	Limitations
Positions of Intellectual and Ethical Development	Structural-developmental model Unidimensional trajectory, nine developmental positions.	Perry (1970)	Seminal study of personal epistemology, separated student evaluation of college experience from emotional development and personality traits. Intricate and monolithic in breadth and depth. Transitions through scheme regarded as more important than the positions themselves.	Hierarchical stages with value emphasis. Later stages less explicitly epistemological. Difficult to operationalise. Developed mainly with male Harvard students in the 1950s, therefore an 'elite sample'. Contemporary students less likely to be dualists on entry to higher education.
Women's Ways of Knowing	Structural-developmental model Source-oriented, unidimensional trajectory, five ways of knowing.	Belenky, Clinchy, Goldberger & Tarule (1986), Clinchy (1995)	Development of and reaction to Perry to encompass feminist viewpoint, self-identity and social construction of knowledge. Attention paid to source of knowledge. More structured approach to methods and procedures than Perry. Advocates constructivist stance to teaching.	Included women not in school, two populations not accounted for in model. Questions raised regarding interview schedule and priming.
Argumentative reasoning	Structural-developmental model Unidimensional trajectory.	Kuhn (1991)	Skills of argument and reasoning linked to epistemological development and 'everyday thinking'. Broad sample including wide age range.	Further derivation of Perry. Labour intensive. Little information given regarding methods or procedures.

Epistemological reflection	Structural-developmental model, four stages.	Baxter Magolda (1992)	Extended work of Perry and Belenky <i>et al.</i> Encompasses reflection as a technique to promote metacognitive awareness. Attempted to quantify epistemological beliefs. Sampled women and men finding gender-related patterns of knowing.	Single site sample. Not representative of minority groups or students of different ages.
Reflective judgement	Structural-developmental model Process oriented, seven stages.	King & Kitchener (1994)	Incorporated reflective thinking Structured interviews used to probe ideas about ill-structured problems Developed over long period with cross-sectional and longitudinal studies Provides more detail to Perry's higher developmental stages	Staged model implies more fixed and less fluid progression than Perry's positions Higher stages rarely attained Researchers require training to perform interviews – now discontinued
Epistemological beliefs	Independent epistemological belief systems model Multi-dimensional, three – five underlying dimensions.	Schommer (1990) and Schommer-Aikins (2004), Qian & Alvermann (1995), Kardash & Scholes (1996), Hofer (2000)	Challenged assumptions of linear and staged hierarchical model for dynamic system of independent beliefs. Teased out beliefs for further analysis Encompassed metacognition. Widely tested with school, college and university students.	Number of components or beliefs open to question. Coarse-grained belief systems. Initially excluded social context and constructed nature of beliefs. Unclear as to degree of independence or covariance of beliefs.
Epistemological resources	Independent non-unitary belief systems Context activated, multi-dimensional models	Hammer & Elby (2002), Louca, Elby, Hammer & Kagey (2004), Niessen (2007)	Rejects ideas of beliefs as stable entities, instead resources are activated by tasks and context. Constructivist stance.	Require investigation using multiple methods in context. Currently developed with schoolchildren and student teachers. Labour intensive, procedural issues.

Hammer and Elby (2002) and Niessen (2007) have challenged the underlying conceptions of the staged-developmental and systems models and have proposed a constructivist form of personal epistemology that is arguably more dynamic and inclusive of teaching and context than other models. However, whilst this is appealing because of the apparently holistic and inclusive nature of the conception of epistemological beliefs as co-constructed or enacted, development is limited to a single study with school age children (Louca *et al* 2004) and student teachers (Niessen 2007). By contrast, there are multiple studies using the developmental frameworks and belief systems model, many of which include higher education students and adult learners.

Developmental models provided the impetus for the development of alternative views of personal epistemology as a system of independent beliefs, developed by Schommer and co-researchers (1990) with a focus on academic knowledge and higher education in colleges and university. The independent epistemological belief systems model was a departure from previous interpretivist approaches such as Perry (1970) and Belenky *et al* (1986) that used thick, descriptive analysis of student interviews which characterised the developmental models.

Based on the strengths and limitations of the models on table 2.1, the research questions in this study are explored using Schommer's (1990) model as a theoretical framework. This can be situated in the higher education framework as a presage or influence on student learning (Prosser & Trigwell 1999). In later sections of this chapter, the case will be made for the adoption of Schommer's (1990) model to underpin the basis for the exploration of student nurse personal epistemologies in this study.

2.7 The Epistemological Belief System Model

The focus of the investigation of personal epistemology in this study is founded on Schommer's (1990) model and later revision (Schommer-Aikins 2004). The model incorporates the core elements previously outlined including:

- Simple knowledge (knowledge as discrete facts).
- Certain knowledge (absolute knowledge exists and will eventually be known).

The epistemological belief systems model has additional dimensions concerned with the acquisition of knowledge, the speed of learning, the belief in an inherent ability to learn and the source of knowledge that is to be learned:

- Innate (Fixed) Ability (IA) – learning ability is innate and unchanging (fixed vs. malleable ability).
- Quick Learning (QL) – learning happens quickly or does not happen at all (quick learning vs. gradual process).
- Omniscient Authority (OA) – authorities have access to information and knowledge otherwise inaccessible to students (gatekeeper vs. self-directed learning).

These are generally stated in the literature from as being from a naïve (Schommer 1994) or less sophisticated epistemological perspective, although each is not intended to be represented by a continuum. These assumptions of naïve and less sophisticated beliefs will be elaborated on further in this section.

A central principle in Schommer's (1990) model and one which distinguishes it conceptually from the developmental frameworks is that beliefs about knowledge are independent of each other. In Schommer's words, beliefs may to some extent develop 'asynchronously' of each other. This independent belief systems model was a reconceptualisation of previous models such as Perry's (1970) in which development was on a staged basis with each stage in the hierarchy suggesting an improvement on the previous one. Schommer-Aikins (2004) supplies as an example of asynchronous

belief development the case of an individual who believes knowledge is complex and also believes it to be unchanging, although personal teaching and learning experiences suggest this scenario might be unlikely. Schommer (1994) acknowledges there is a need for balance in this conceptualization, and to facilitate this, proposes beliefs can be visualized as ‘frequency distributions’ as in figure 2.1, rather than as resting points or stages on a linear continuum. Thus, there is the implication that they are dynamic and malleable entities and open to modification or activation in different teaching contexts.

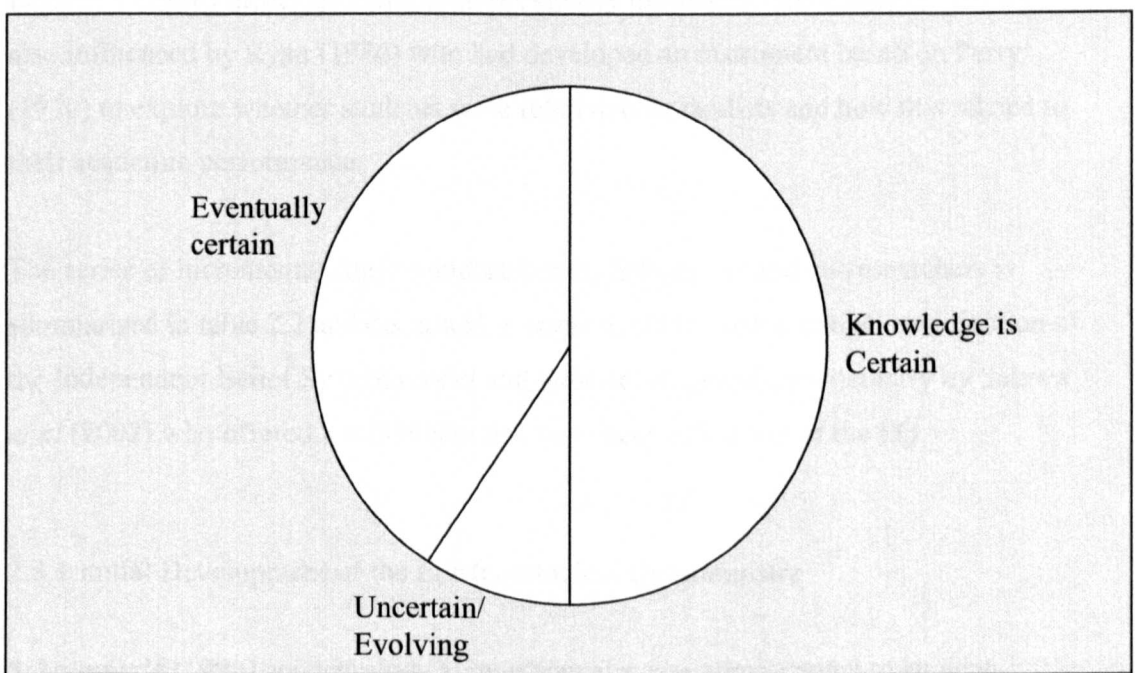


Figure 2.1: Epistemological belief in certain knowledge represented as a frequency distribution (Schommer 1994).

In this schema, more developed or mature beliefs support higher order thinking, and using the example of belief in the certainty of knowledge in the diagram, it could be hypothesised asynchronous development of one belief will affect other beliefs. In addition, there was a requirement for balance as extreme epistemological beliefs could be the cause of problems for an individual (Schommer-Aikins 2004). The diagram can be interpreted as an individual who mainly holds beliefs about knowledge as certain

and stable, but they also hold a proportion of beliefs that knowledge is uncertain and evolving.

This departure from the previous schemes of development reconceptualised beliefs into a manageable system for researchers and teachers to apply in practice. This is evidenced by a body of research that explored student epistemological beliefs using the Epistemological Questionnaire (Schommer 1990), which is examined further in the following sections. Using the labels 'naïve' and 'sophisticated' in relation to an individuals' beliefs parallels the developmental models such as Perry (1970), but has value implications with 'naïve' being not as good or desirable as 'sophisticated'. Arguably, Schommer-Aikins' (2004) conceptualisation of individual beliefs as frequency distributions removes some of the value judgement implied by the staging inherent in the developmental models. This is in alignment with a constructivist view of learners as being able to develop and mature as knowers (Piaget 1973).

2.8 Development of the Epistemological Belief Systems Model

Development of Schommer's (1990) independent Epistemological Belief System model was underpinned by the development of the 63 item Epistemological Questionnaire (EQ). The dimensions of the proposed model were investigated using items derived principally from the Checklist of Educational Views (CLEV), a forty-six item instrument with a six point Likert scale focusing on dualist versus relativist thinking based on a questionnaire designed by Perry (1970). Also, it incorporated work by Schoenfeld (1985) with students studying mathematics and Dweck and Leggett's (1988) theory of motivation previously discussed. Schommer (1990) was also influenced by Ryan (1984) who had developed an instrument based on Perry (1970) to explore whether students were relativists or dualists and how this related to their academic performance.

The series of incremental studies undertaken by Schommer and co-researchers is summarised in table 2.2 and discussed in some detail to enable critical examination of the Independent Belief System model and later developments, particularly by Schraw *et al* (2002) who offered a refinement and re-conceptualisation of the EQ.

2.8.1 Initial Development of the Epistemological Questionnaire

Schommer's (1990) epistemological questionnaire was administered to students undertaking introductory psychology or physics following a pilot study (Schommer 1988). The EQ was one of four instruments including a demographic survey, a vocabulary test and an unspecified 'filler task'; the rationale for inclusion was to keep early finishers occupied prior to the end of the survey. Five epistemological dimensions previously discussed were intended to be studied using twelve subsets of items in the questionnaire. These surveyed preferences to statements about knowledge and learning to which responses were made using a five point Likert scale (1; strongly disagree to 5; strongly agree). Mean subscale scores, rather than individual item scores were factor analysed using principle axis factoring. Items with eigenvalues greater than one were selected to retain as factors and subject to varimax rotation which was interpreted as indicating a four factor structure.

Table 2.2: Summary of studies underpinning the development of the Epistemological Belief System model.

Key: EQ – Schommer’s Epistemological Questionnaire GPA – grade point average

Study	Focus	Sample details	Key findings
Schommer (1988)	Pilot of the epistemological questionnaire (unpublished presentation reported in Schommer 1990).	100 high school freshmen.	Beliefs in quick learning and certainty of knowledge indicated conclusions about an ambiguous text passage.
Schommer (1990)	Students’ beliefs about the nature of knowledge.	266 junior college students, university freshmen or sophomores (second year students) undertaking introductory psychology or physics classes. Subsample 86 students for comprehension test.	EQ accounted for 55% variance in the sample. Analysis indicated four factors supporting the independent beliefs model: ‘ability to learn is innate’ ‘knowledge is discrete and unambiguous’ ‘learning is quick or not at all’ ‘knowledge is certain’ Linked to comprehension testing and demographic variables – female students more likely to indicate belief in gradual learning.
Schommer, Crouse & Rhodes (1992)	Epistemological beliefs and mathematical text comprehension.	Main sample - 424 university students (157 male, 267 female) enrolled on a psychology class. Mean age 22 years, range 17 – 65 years. Subsample for comprehension test - 138 students, mean age 25 years, range 17 – 65 years.	Replicated 1990 study factor structure findings using exploratory and confirmatory factor analyses, but eigenvalues reduced from 1.0 to 0.95. EQ explained 46% of variance. Students who indicated less naïve beliefs in quick knowledge had higher comprehension test scores – quick learning predicted test performance. Was not related to levels of prior knowledge or student gender. Beliefs in simple knowledge predicted study strategy and overconfidence in self-assessment of text understanding.

Schommer (1993a)	Influence of epistemological beliefs on academic performance (grade point average).	1182 high school students in years one to four (541 males, 641 females) Cross-sectional design.	Replicated 1990 study four-factor structure, eigenvalues reduced from 1.0 to 0.98. EQ explained 53% of variance. Epistemological beliefs develop in high school – suggested beliefs in simple and certain knowledge, quick learning decrease with progression through school. Students who indicated less naive beliefs in quick learning had higher GPAs.
Schommer (1993b)	Comparisons of high school and university student epistemological beliefs.	Further analysis of 1990 data.	Junior college and university students differed on all beliefs. University students more likely to believe in innate ability. College students more likely to believe in simple and certain knowledge and quick learning. Beliefs were general rather than discipline specific in college students. Higher levels of parental education had effects on epistemological beliefs in simple knowledge and quick learning.
Schommer & Walker (1997)	Epistemological beliefs and valuing school.	More than 1000 high school students Stratified random sample of 158 students taken from main sample.	Used vignette about attending college. Eleven open-ended questions based on the vignette were coded and a twelfth added to reflect the overall tone of the student responses. Inter-rater reliability reported as 95%. Certain knowledge and quick learning predicted whether participants indicated the vignette student should attend college. Students who indicated higher beliefs in certain knowledge indicated the student character in the vignette should attend college. High school student beliefs change over time and predicted achievement (GPA).
Schommer, Calvert, Garigletti & Bajaj (1997)	Longitudinal development of epistemological beliefs.	69 students in first and final years of high school.	
Schommer (1998)	The influence of age and education on epistemological beliefs	418 adults, 18-68 years old ($M = 38$, $SD = 12.3$), stratified random sampling.	Age and education affect beliefs – age predicted beliefs in innate ability, educational background predicted beliefs about simplicity and certainty of knowledge.

Factors were labelled on the basis of the high loading groups of items derived from the exploratory analysis and rotation. Four orthogonal factors accounted for a good proportion of the total sample variance, but the fifth hypothesised factor, omniscient authority, was not evident from the analysis. Descriptive labels for the factors were:

- Ability to learn is innate
- Knowledge is discrete and unambiguous
- Learning is quick or not at all
- Knowledge is certain

The data were subject to further exploratory analysis using oblique rotations, but those analyses and solutions were reported as less straightforward to interpret which was taken as evidence to support the four-factor or four belief structure.

To further the analysis Schommer (1990) hypothesised connections between the epistemological beliefs and student characteristics which were studied using an extended demographic survey. Questions were asked not only about age, gender and classes at school, but also about details of parental education. The links between the effects of epistemological beliefs and student background variables, particularly simple knowledge and quick learning, were explored using stepwise regression analyses. It was suggested that:

- Higher levels of formal parental education and increased responsibility in the home were related to a greater proportion of sophisticated epistemological beliefs in the students.
- When more classes were attended, there was a greater belief in the tentativeness, rather than certainty of knowledge.

This was interpreted to indicate that students who were exposed to more advanced conceptions of knowledge through higher levels of study were more likely to experience a change in their belief systems.

A further component of this study was to test the hypothesis that relationships existed between epistemological beliefs and aspects of comprehension, specifically

conclusions drawn performance in a mastery test and comprehension monitoring. A reading comprehension test was employed using two different text passages on issues from psychology and nutrition. Results from student conclusions about the passages and a confidence rating were entered into multiple regressions. These indicated:

- Beliefs in quick learning could predict oversimplified conclusions.
- Beliefs in certain knowledge and prior knowledge predicted certain conclusions.
- Quick learning predicted performance on the psychology mastery test.

It was reported that none of the factors predicted performance on the nutrition test because of floor and ceiling effects in several items. However, there was no effect found for the text passage discipline and the effects of quick learning and certain knowledge occurred across the discipline in this phase of the study.

In summary, this line of research offered a novel and different view of personal epistemology as a system of more or less independent beliefs. This was in response to previous conceptions of epistemological belief as dualistic and development occurring on a staged trajectory with certain positions more advanced or better than others, for example Perry (1970). By contrast Schommer's (1990) conception of epistemological beliefs could be interpreted as less judgemental and more rounded in that an individual who indicated they held more 'naïve' beliefs still had a proportion of more sophisticated beliefs on the same dimension. This study using the EQ was developed by Schommer and co-workers to investigate the effects of epistemological beliefs on further educational factors in a series of studies detailed below.

2.8.2 Effects of Epistemological Beliefs on Academic Achievement

Schommer *et al* (1992) replicated previous findings with a cross-sectional sample of university students using the same factor analytic approach, which initially resulted in a three factor structure explaining a reasonable proportion of variance. Repeating the factor analysis with a reduction of the eigenvalue cut-off point resulted in a four factor structure. Confirmatory factor analysis (CFA) indicated the four factor model had a more acceptable fit than three factors, although there was limited reporting of results which makes it difficult to judge these results by current standards (Brown 2006).

The reading comprehension test was repeated to explore whether belief in simple knowledge could predict understanding of a statistical text. Student rating of comprehension was used to assess overconfidence in understanding the passage. Also, students completed a short statistical test and the Learning and Study Strategies Inventory (Weinstein *et al* 1987), an 80 item questionnaire designed to assess factors such as study motivation, attitude, interest and concentration. The hypothesis was that students could cease studying too soon if they thought they comprehended an issue or subject, whereas those with less confidence in their ability, but who still achieve academically, were likely to persist in studying. It was concluded that beliefs in simple knowledge were negatively related to comprehension possibly mediated by approaches to studying.

A later cross-sectional study (Schommer 1993a) with high school students produced a four-factor solution from exploratory factor analysis. Schommer (1993a) reported confirmatory factor analysis on both solutions supported the four factor model. Again, there is limited detail regarding the CFA procedures or results other than a short footnote, so the fit indices of the four factor model cannot be evaluated. This aspect was highlighted by Hofer and Pintrich (1997) who raised doubts about the questionnaires' substantive validity because there was no CFA performed using the full set of 63 Epistemological Questionnaire items, only the mean subscale scores.

The new development in this study was an examination of the influence of epistemological beliefs on academic achievement by regressing grade point averages

(GPA) against the four epistemological factor scores and archived intelligence quotient scores. The results from this and MANOVAs indicated:

- Higher achieving students believed less in quick learning, simple knowledge, certain knowledge and fixed ability
- Verbal IQ scores and quick learning were also significant predictors of achievement.
- Female students were less likely to believe in fixed ability and quick learning.
- As students proceeded through school they were less likely to believe in simple knowledge, quick learning or certain knowledge.

However, the cross-sectional design was a limitation recognised in this study. The attrition of students with less sophisticated beliefs was a potential factor which may have influenced the results (Schommer 1993a). To extend this line of enquiry, students in a longitudinal study (Schommer *et al* 1997) demonstrated maturation in all epistemological beliefs and the less they believed in quick learning, the higher was their level of achievement. These studies were important in personal epistemology research because they established links between education (academic performance) and student personal epistemologies. A key development in these studies was that Schommer raised the possibility of a link between epistemological beliefs and student attrition.

2.8.3 Epistemological Beliefs and Discipline of Study

In an extension of the first study Schommer (1993b) reanalysed the 1990 data from educational psychology and physics students. Key findings indicated university students were more likely to have higher beliefs in innate ability whilst the college students indicated higher beliefs in simple and certain knowledge. Results replicated the earlier findings in relation to the effects of family life (Schommer 1990), but added discipline of study. The only significant differences were mainly male physics students tended to believe in quick learning and younger educational psychology students in the simplicity of knowledge. It was observed the differences between students in each discipline were not as clear or divisive as might be thought.

More recent work supports this finding and suggests the epistemological beliefs are both domain general and domain specific (Muis *et al* 2006), and suggests the specificity/generalizability debate may be focused on a false dichotomy. It has also been proposed that different epistemological beliefs would apply to different disciplines, but what is more important is how they develop (Commons 2004, Greene *et al* 2008), and how teaching and socio-cultural influences might effect that development (Muis *et al* 2006, Hofer 2008).

Schommer (1993b) observed that the model was not a prescription for an ideal personal epistemology, but took a more pragmatic stance, suggesting the model could provide an initial basis to develop interventions to facilitate belief change, hinting this could also be applied to teachers. Furthermore, it was stated that epistemological beliefs could not be comprehensively measured by an instrument but in combination with dialogue could aid teachers in 'epistemological assessment'.

2.8.4 Epistemological Belief and Perceptions of Higher Education

Schommer and Walker (1997) used the EQ in a study of Midwestern US high school students and their perceptions of continuing in college education. An interesting development was the use of a textual vignette about a student making decisions to attend college instead of a comprehension test. The EQ was distributed and completed in conjunction with the vignette which had open ended questions aimed at eliciting perceptions around continuing in education or leaving for employment. A random sample was taken and this was stratified into 'gifted' and 'non-gifted' students based on existing data from state intelligence tests.

It was argued that this added to the evidence that epistemological beliefs were not an 'esoteric, philosophical phenomena' (Schommer & Walker 1997) but were an important influence on students' everyday views about continuing their education reflected real concerns about going to college. In terms of beliefs, beliefs in certain knowledge and quick learning predicted whether participants indicated that the student in the vignette should attend college. One finding that was potentially counter-intuitive was that students who indicated higher beliefs in certain knowledge indicated

the character in the vignette should attend college. It is suggested that this reflected the ages of this student sample which were not specified as such, but ranged from freshmen to seniors, generally 14-18 years of age. The interpretation in previous research was that higher levels of belief in the certainty of knowledge were characteristic of adolescents who were not ready to acknowledge and cope with the uncertainty of knowledge. Schommer and Walker (1997) suggest this could also be a result of the confidence students have in themselves and the educational system. This is slightly ambiguous as it is not clear if it is a reflection of student confidence in the system, or a result of the education system presenting knowledge as certain. However, what is important is this has implications for higher education research as it is students of this age group who proceed into education programmes in colleges and universities.

2.9 The Embedded Systemic Model

Schommer-Aikins (2004) recognised epistemological beliefs could not be studied in isolation and further research and development of the Independent Belief System model was needed to recognise the impact of extended factors (figure 2.2). This widening of scope was in common with previous models such as Belenky *et al* (1986) which included the effects of authority figures and self-identity. The revision was proposed to encompass ‘cultural relational views’ defined as social relationships including peer-type relationships, hierarchical and cross-cultural aspects. This final development to integrate the Epistemological Belief System within a wider social context was not supported with research, but, instead, Schommer-Aikins (2004) invited future researchers to fill in the missing gaps. It is contended that investigating relationships between student nurse personal epistemologies and their approaches to study can contribute to ‘filling in gaps’ and is one of the purposes of this research.

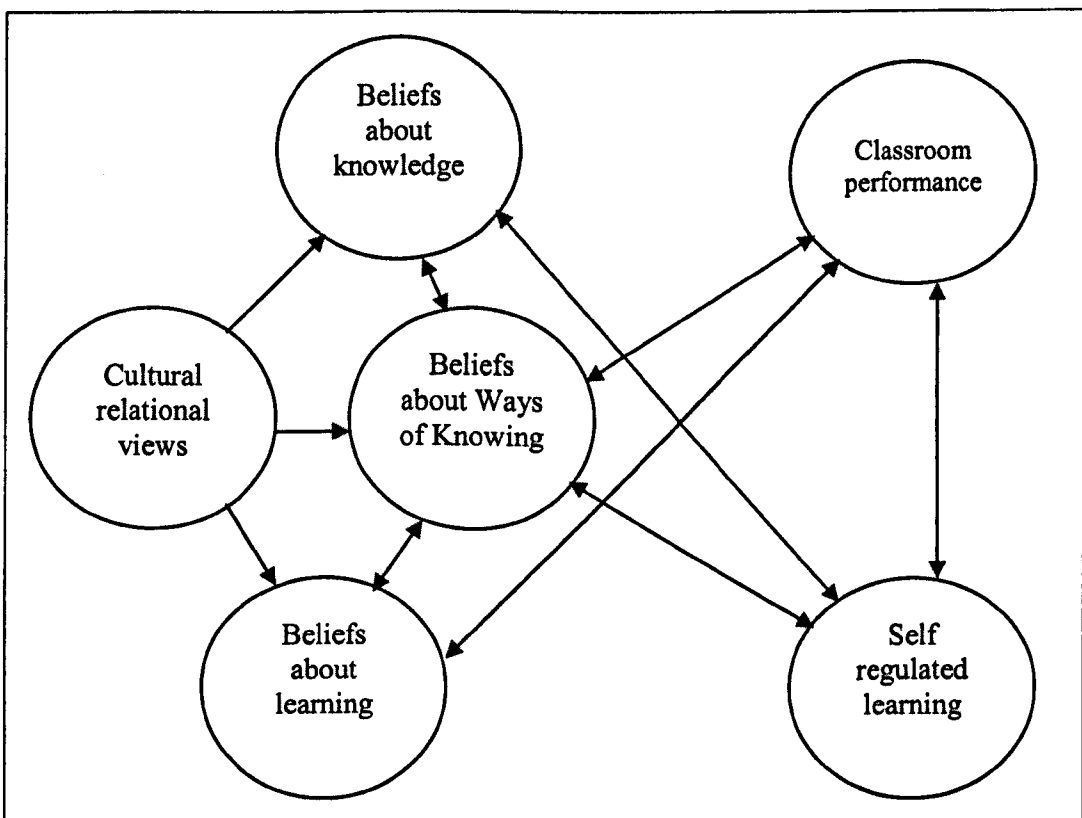


Figure 2.2: Schommer’s (2004) Independent Epistemological Belief System within the Embedded Systemic model.

2.10 Criticism of the Independent Belief Systems Model

The independent belief system model has not been without criticism, and this has mainly been concerned with the conceptual basis of the model (Hofer & Pintrich 1997, Rozendaal *et al* 2001). This is centred on two beliefs, innate ability and quick learning.

Hofer and Pintrich (1997) criticised the inclusion of fixed (or innate) ability into Schommer's (1990) model. It was claimed it was a psychological construct regarding intelligence derived from Dweck and Leggett's (1988) theory of motivation and personality and not a component of personal epistemology theory. Dweck and Leggett's (1988) findings demonstrated how children with a strong belief in an ability to learn would persist at a difficult task. Individuals have different personal constructions of their intelligence and may predispose a person to particular cognitive-affect-behaviour performance responses in challenging circumstances. Two types of response were proposed, 'mastery-oriented' where challenges and obstacles are sought and an individual will work at finding solutions to them, and 'helpless' behaviour where there is an avoidance of problems and deterioration in performance with time. However, it was observed capable students could display helpless responses and this could occur in students initially of equal ability (Dweck & Leggett 1988).

Differences also occurred in relation to the goals set by the individual. Those who saw goals as performance-oriented sought favourable judgement of their competence in order to maintain self-esteem in the eyes of teachers and peers viewed intelligence as a fixed entity and were more susceptible to helpless behaviour. The mastery-oriented responses were associated with learning goals by which individuals could increase their competence and viewed intelligence as malleable. This has resonance with findings from Bråten and Olaussen (2005) in their study of Norwegian student nurses and business administration students in relation to motivation. In year two of study, the top 10% of achieving business students in the study remained highly motivated, possibly as a result of attention by academic staff and potential employers as a result of their performance whilst it appears the motivation of the other student clusters decreased.

Quick learning was derived from work by Schoenfeld (1985, 1994) in which mathematics students solved geometry problems and expressed ideas about speed of learning, with authority handing down knowledge and gifted authority individuals being the only ones who could truly understand mathematics. In other words, from the student perspective, if learning comes from teachers (omniscient authority), they are experts who learn quickly.

The two beliefs were incorporated as the dimensions of fixed ability and of quick learning which were previously not regarded as the dimensions of personal epistemology. Hofer and Pintrich (1997) have criticized the conceptual clarity of Schommer's (1990) model on the basis that these dimensions were about beliefs about acquisition of knowledge, rather than beliefs about the nature of knowledge and how it is known. Schommer-Aikins (2004) countered this by justifying the inclusion of the construct because, in her opinion, learning beliefs can 'unveil' students' thinking about sources of knowledge which would clearly be of interest to teachers.

Hammer and Elby (2002) are critical of the 'unitarity' (p 171) of the beliefs and the misconceptions stance (i.e. beliefs are naïve or sophisticated) evident in Schommer's (1990) model, despite claims that it is more constructivist than the developmental models. In particular, they criticise the lack of evidence of raw building blocks of epistemological beliefs. Knowledge may be regarded as certain or tentative, but it is argued there is no suggestion in Schommer's model of what could epistemological resources be used to promote development. Their argument reflects criticism of the field of personal epistemology as a whole, that of a lack of a unified model and terminology, which is discussed further in 2.14. However, as previously stated, and in contrast to Schommer's (1990) research Hammer and Elby's (2002) epistemological resources model is still largely untested and undeveloped and has not been applied in research in higher education with university students.

2.11 Section Summary

To summarise, the key features of the Schommer's (1990) independent belief systems model are:

- Personal epistemology can be characterized as a system of more or less independent beliefs which have effects on comprehension and learning.
- Independent epistemological beliefs may develop asynchronously and can be visualized as 'frequency distributions'.
- The independent belief systems model offers an alternate view to the idea of the development of beliefs along a fixed trajectory.
- Epistemological beliefs develop and change over time, which contrasts with inherent and fixed personality traits.
- Epistemological beliefs are influenced by socio-demographic factors and have effects that were observed to occur across discipline domains.
- The Epistemological Questionnaire (Schommer 1990) could be used to assess epistemological beliefs in addition to facilitating dialogue with students.
- Epistemological beliefs are related to reading comprehension, student achievement and intent to enter higher education. This makes them potentially relevant to concerns about student attrition.

The series of studies by Schommer (1990) and her co-researchers onwards are important because they demonstrate increasing quantitative development of the Independent Epistemological Belief System model and the effects of personal epistemologies on a wide range of factors affecting student learning including student achievement. The Epistemological Questionnaire enabled statistical links to be made to these various factors. Schommer (1993b) openly acknowledged the limitations as well as the benefits of her research, and also demonstrated ingenuity in overcoming problems related to methods. The development of this questionnaire and rationale for using it in the nurse education context will be explained in further detail below and in the next chapter.

2.12 Nurse Education Studies exploring Personal Epistemology

There is a paucity of literature explicitly concerned with both student nurse personal epistemology and their approaches to learning as a combined area of interest. However, there are a handful of studies which have attempted to explore the areas separately. The first of these examined here is included because it does not directly refer to epistemological beliefs, but did study areas pertinent to personal epistemology.

2.12.1 Subject-Specific Attitudes

Thornton's (1997) study of attitudes towards the relevance of supporting science subjects in a pre-registration degree curriculum tacitly referred to epistemological beliefs. A participant-oriented curriculum evaluation approach was used to explore Australian first and second-year students' and teaching staff perceptions of 'supporting sciences' and their relevance. Supporting sciences were biological, behavioural and social sciences and humanities taught by staff from other faculties.

Student opinions on the relevance of the supporting sciences during initial discussions were then used in the construction of an 'opinionnaire'. This survey instrument probed teaching staff views on nursing as a profession, the significance of the respondents' discipline within the curriculum and what guided the inclusion of content and teaching methods. In addition, a convenience sample of 108 second year students were asked to provide unstructured written responses to keyword cues. This was justified by Thornton (1997) on the basis that those students had experienced the first year and thus could reflect back on the application of theory to practice. Further classroom-based observations of teaching methods were undertaken by the researcher during lecture and practical skills teaching sessions.

Content analysis methods were employed to construct key themes from the data:

- Perceptions of nursing influenced both content selection and depth of study

- Superficial study approaches were employed by students in response to certain teaching and assessment methods
- Perception of the reality of nursing practice drove perceptions of relevance and applicability of content

First year students reported preferences for studying highly structured units with prescriptive supporting reading and assessment, such as anatomy, which was viewed as 'essential'. Thornton (1997) observed this was possibly because the logical and systematic presentation and factual nature of this subject offered the students 'comfort and security' (p183) at the beginning of their course. This may also reflect the dominance of a biomedical model influencing the curriculum at that time. By contrast, nursing theory subjects were perceived as more abstract, were less popular and lacking in relevance. Second year students' responses about the supporting sciences focused on recall of information and that multiple choice examination was a preferred mode of assessment rather than written assignments.

Connections can be made between these findings and the conceptions of personal epistemology evident from Schommer's (1990) model. Students in this study demonstrated preferences which reflected less sophisticated levels of belief in quick learning and simple and possibly, certain knowledge. Thornton (1997) did not define what was meant by attitudes or perceptions towards subjects in the context of the study which can be regarded as a limitation in terms of what was being measured.

There have been three studies with an explicit inclusion of or focus on personal epistemologies of nurse students which have reported using the EQ. These are outlined here with an assessment of their contribution to nurse education knowledge and personal epistemology research.

2.12.2 Cognitive Development and Diagnostic Ability

Aquilino (1997) included Schommer's (1990) EQ in a survey to explore the relationships between cognitive development, diagnostic ability and experience focusing on the nursing care of childbearing women and their families. To summarise, the key points were:

- A convenience sample of fifty-five students aged 19 to 40 ($M = 24$) in their first ($n = 8$), third ($n = 12$), fourth ($n = 16$) and fifth ($n = 19$) semesters from three baccalaureate nursing programs from Iowa.
- Nursing knowledge was measured using a multiple choice and diagnostic ability test using two scored text simulation devised by the author.
- The EQ total scores were reported in the results, and, although the four-factor structure was mentioned, the main thrust of the reporting on cognitive development was purely descriptive with total scores reported per semester, which decreased from 299.6 in semester one to 215.5 in semester five.
- Cognitive development scores were not significant when entered in regression analyses with knowledge and experience, but a moderate relationship was found to participant age.
- Cognitive development scores were significantly correlated with other tests: they were weakly negative with diagnostic ability scores and weakly positive with knowledge test scores.
- Subscale scores were not reported, nor any analyses to test whether scores were statistically different across the semesters, possibly as a result of the small sample size, although a chi square statistic might have offered further insight. Furthermore, there is no indication of how the questionnaire responses were processed.
- Conclusions were that the student scores on the EQ indicated they were in a 'multiplistic' stage according to Perry's (1970) classification. This was interpreted as indicating they were accepting of diversity and different opinions, but still sought the opinion of an authority for a 'right' answer.

Arguably, using Schommer's (1990) EQ to measure the positions on Perry's (1970) developmental model was a procedural issue that contradicted the purpose of the

Belief System Model and more detail could have been extracted from this dataset.

However, this was an important study in that it demonstrated temporal changes in the epistemological beliefs of nurse students. Also, there was an indication that there was a 'backslide' in cognitive development from the first to fourth years of study, an issue which will be discussed later in the results of this study.

2.12.3 Epistemological Beliefs and Study Motivation

A recent application of the EQ was in a study of Norwegian student nurses and business administration students by Bråten and Olaussen (2005) in relation to motivation. In all, their sample comprised 99 student nurses, 64 full-time and 36 part-time and 105 business administration students who completed six questionnaires focusing on study interest, motivation and included a modified version of Schommer's (1990) EQ. This was based on two dimensions derived from previous study concerned with the speed of knowledge acquisition and beliefs about knowledge construction and modification (Bråten and Strømsø 2005). The students completed the questionnaires in the first and second years of study.

Key findings indicated:

- 37% of student nurses who were rated as positively motivated to study in year one remained so in year two and 54% were rated as moderately motivated in year two.
- This change in motivation was also apparent in the business students, but the findings of changes from year one to two were more mixed than student nurses.
- Changes in motivation were linked to the personal epistemology measure through MANOVA procedures which indicated there were significant differences in three clusters of student nurses.
- Students who were in a low motivation cluster were more likely to indicate beliefs in quick learning and stable knowledge and less sophisticated beliefs about knowledge construction.
- By contrast, those in the higher motivation cluster were more likely to hold more sophisticated beliefs about the nature of knowledge and knowledge acquisition,

and indicate beliefs in gradual acquisition of knowledge and that it is constantly evolving.

The study provided insight into the issue of how personal epistemology might influence student nurse motivation to study. An interesting conclusion was made concerning the mixed nature of the clusters with regard to the aspects of learning that were studied. As expected and supported by the literature, students reporting high levels of motivation adopted deep processing strategies and those reporting low levels of motivation used them the least, but there were a group of student nurses who reported they were highly motivated but adopted surface strategies.

This finding was directly comparable to those from the business students, indicating some consistency across two different disciplines. This has resonance with results from Schommer *et al* (1992) where beliefs in simple knowledge predicted study strategy and overconfidence in self-assessment of text understanding. Also, the findings regarding motivational change echo Aquilino's (1997) findings. By contrast to the research questions in this study, the motivation element of the research focused more specifically on self efficacy and study interest, rather than investing specific learning styles or study strategies.

2.12.4 Personal Epistemology and Locus of Control

More recently in a study of 350 Turkish undergraduate student nurses, Yilmaz and Kaya (2010) used an adapted and translated form of the EQ to study the effects of epistemological beliefs on locus of control. They investigated epistemological beliefs based on three dimensions, belief that learning depends on effort, belief that learning depends on ability and belief that there is only one unchanging truth which explained only 28% of the sample variance.

The key findings were:

- Students who indicated less sophisticated beliefs in ability were more likely to have an internal rather than external locus of control.

- Students in the sample indicated high mean scores on the belief in unchanging truth, which Yilmaz and Kaya (2010) attributed to the Turkish school system.
- Further analyses indicated beliefs in the ability scores significantly increased from first to fourth year and the other beliefs did not develop over the course.

Confirmatory factor analysis was used to support fit of the data to a three-factor model, but very limited fit indices are reported. Furthermore, the amount of variance explained by the extracted factors is low when social science questionnaires might be expected to explain 40-50% of variance, even when exploring vague constructs (Oppenheim 2001). Whilst this study addresses the nature of epistemological belief in student nurses, these are limitations that make the results questionable and open to criticism.

2.12.5 Section Summary

The studies outlined in this section demonstrated the limited research into student nurse personal epistemologies and areas related to approaches to studying. The key areas studied include diagnostic ability, motivation and locus of control. Whilst these may influence approaches to learning, this area has not been investigated in published research.

2.13 Discussion

There is little direct criticism of the Schommer's (1990) Independent Belief System model beyond the issues raised by Hofer and Pintrich (1997). However, criticism of research into personal epistemology in general is applicable to this model and the line of research into belief systems. A key criticism of the field is that it is apparent that most of the models require further empirical testing and development and have yet to develop finer detail, if that is possible (Schraw 2001, Hammer & Elby 2003, Mayer 2003, Greene *et al* 2008). Furthermore, as Knight and Mattick (2006) observe in their study of medical students, 'snapshots' provided by current research methodologies appear to serve to illuminate shortcomings in methodology. This is by contrast to reflecting the rich complexity, depth and dynamism that are more likely to be features

of more developed models of personal epistemology as suggested by Hammer & Elby (2003) and Niessen (2007). However, Schommer's (1990) Independent Belief System model and the EQ provide a pragmatic means to investigate personal epistemology, which facilitates the study of large groups of individuals relatively quickly and economically. In this discussion of issues arising from personal epistemology research there are a number of key areas of criticism that are worth elaboration.

2.13.1 The Unified Model Problem

The models of personal epistemology briefly outlined and critiqued here indicate the central issue in personal epistemology; a lack of a unified theoretical model (Schraw 2001, Mayer 2003, Greene *et al* 2008). This however is not seen as a weakness by Hofer (2002) who regarded personal epistemology research at that date as having greater credibility and with the main building blocks in place to support more research. Concurrently, Mayer (2003) made the somewhat scathing assertion that a discipline with a history of forty years yet still regarded as in its infancy by key researchers such as Schraw *et al* (2002) and DeCorte *et al* (2002) because of a lack of unified theory has to be regarded with a degree of caution or scepticism, particularly because of the publishing record. Much research has been published in books, individual chapters and secondary journals. In defence, Hofer and Pintrich (1997) and Mayer (2003) point out this could be a consequence of the strengths and weaknesses of methods used for investigation, which have primarily been 'paper and pencil' questionnaires or rich qualitative interviews, and this view is acknowledged by key authors in the field (Hofer & Pintrich 1997, Schraw *et al* 2002, Muis *et al* 2006). Arguably this literature review demonstrates research findings have now reached mainstream educational psychology journals (Cano 2005, DeBacker & Crowson 2006, Ordonez *et al* 2009), albeit principally quantitative research, thus rendering the critique concerning quality of published work no longer valid.

However, at present, each theory or model has differing elements, developmental stages and units of analysis derived from studies of different disciplines. Furthermore, not all are open to empirical testing or replication, which has opened the field to criticism (Mayer 2003, Limón 2006, Niessen 2007). As outlined above, this may in

part be due to the methods used, with reliance in the main on either questionnaire-oriented research (Hofer 2002, Schommer-Aikins 2002) or open-ended and semi-structured interviews (Perry 1970, Belenky *et al* 1986, King & Kitchener 1994). The qualitative methodologies have led to rich, insightful exploration from a diverse range of viewpoints, but, in arguments echoing the quantitative-qualitative debate, these are criticized for lack of statistical power and failure to recognise other theories (Mayer 2003). Questionnaires such as Schommer's (1990) EQ and the Schraw *et al* (2002) EBI have fundamentally evolved from Perry's (1970) original work and rely on self-report instruments to capture complex cognitive issues, raising questions about construct validity (Duell & Schommer-Aikins 2001, Louca *et al* 2004). The quantitative focus is by definition reductionist, although the Embedded Systemic Model (Schommer-Aikins 2004) may be regarded as a means to resolve this, although it appeared to be positivist in conception.

Personal epistemology therefore needs to embrace studies from a variety of methods and perspectives to flesh out a fuller, more unified theory than currently exists. This will involve methodological reconciliation and an acknowledgement that there is not a best methodology or method to approach this, and it is unlikely there ever will be because of the complexity of the epistemological beliefs held by different individuals. There appears to be evidence of wide variation and culturally-specific differences (Hofer 2010), but that does not mean there cannot be a core set of concepts that can provide a common language and be modelled. A further issue in addition to the lack of a unified theory of epistemological beliefs (Schraw 2001, Bendixen & Rule 2004) is the majority of research studies thus far have been grounded in high school and university education, so it is unclear how beliefs about knowledge and learning develop in the world outside of those environments.

However Schommer's (1998) report of a study of the epistemological beliefs of 418 adults aged 18-68, who had backgrounds of either no secondary education, undergraduate or graduate education aimed to address this deficiency. Regression analyses indicated older adults had less naïve beliefs about innate ability and educational background predicted beliefs in certainty and simplicity of knowledge, with graduates indicating less naïve beliefs. In other words, this was interpreted as

meaning beliefs about the ability to learn changed with time, but age alone was not an indicator that beliefs about knowledge would change.

In a study of jurors in New York using a developmental scheme for analysis, Weinstock and Cronin (2003) provide suggestive evidence of links between how jurors weighed up evidence and how this linked to their epistemological beliefs as opposed to educational background, age or gender. This application of personal epistemology research outside of education indicates that it can be applied to real world issues where individuals are confronted with complex problems requiring different forms of knowledge to formulate solutions. However, it is likely this will be a disparate area of research until there is consensus over what constitutes core beliefs, how they are inter-related and how belief change occurs.

2.13.2 The Language of Personal Epistemology Research

The variation in terminology used in personal epistemology models could be indicative of why there are criticisms of what is regarded as an emergent branch of educational psychology (Mayer 2003). Niessen (2007) elaborates on this issue with a particular attack on the use of nouns for labelling the 'building blocks for thinking', which creates an impression of an unchanging, static state and a barrier to developing dynamic process models. Niessen (2007) is also critical of the tendency to portray epistemological beliefs as dichotomous with either-or categories also seen as a feature of other psychological constructs, for example external and internal. The view that reductionism is inherent in the construct labels is in agreement with Hammer and Elby (2002) who cite Dennett's (1991) argument that it is a fallacy to construct our ideas about consciousness in terms of separate ontological units, and personal epistemology should be regarded in the same way. Theories and traits have a use for convincing a particular audience of the existence of ideas, especially those who are sceptical when challenged with the unfamiliar.

In a challenge to the constructivist and positivist bases of the unitary conception frameworks and models, Hammer and Elby (2002) question what is important is not the presence or absence of more or less developed beliefs (conceptions vs.

misconceptions), but the presence of resources for understanding knowledge which can be activated or de-activated through educational activity. Theories of unitary conceptions and conceptual change suggest misconceptions need to be made explicit, then confronted and replaced, whereas epistemological resources could be harnessed through education enabling students to draw on productive resources. This has resonance with methodological advances such as the use of gerunds to convey a sense of process to grounded theory as advocated by Charmaz (2006a).

It is not the intention to resolve this issue here, and if any criticism of the stance of the constructivist-enactivist epistemologists can be made, then it is in relation to the unified theory problem. That is, a model is required with core concepts and language to facilitate future research. If Schommer's (1990) model is not meant to be taken literally and Schommer (1993b) does take deliberate care to inform us that the independent belief systems model was one under development and was not presented as the 'prescription for the ideal epistemology' (p367). The EQ was designed to be one element contributing to a range of approaches to working with student personal epistemologies. Measurement using the EQ at intervals could be used indicate how beliefs change over the longer term (Schommer 1993b, Schommer *et al* 1997), but could be used with other measures or observations to explore changes on the day-to-day scale. Many teachers are intuitively able to report when they see 'the light go on' when a student grasps a difficult concept or solves a difficult problem. This intuitive knowledge should not be under-estimated and tools such as the EQ can act as an adjunct to teacher judgement.

2.13.3 Self-report Instruments and Student-Focused Research

Muis *et al* (2006) have criticised studies based on questionnaires which rely on Likert scales, questioning how these instruments could discriminate and capture the complexity and measure development of epistemological beliefs. This aspect is discussed in greater depth in the methodology for this study, particularly with regard to how accurately participants conceive their own cognitive abilities. The use of scales and the focus on individuals is picked up by Niessen (2007) in relation to the beliefs as units issue raised by Hammer and Elby (2002), claiming it perpetuates the

conception of beliefs as stable traits and that there is a tacit issue of diagnosis and control. Furthermore, a recurrent theme in many of these studies is a reliance on samples of students studying psychology or educational psychology, who, in some universities have to consent to take part in studies in their departments and are also culturally adapted to investigation of this type using questionnaire instruments. To counter this criticism, proponents of self-completion questionnaire instruments claim they have opened up and facilitated research into personal epistemology, particularly the relationships between epistemological beliefs and reading, comprehension testing and academic achievement (Schommer 1990, Schraw *et al* 2002). Ethical aspects of the student as research participant are also addressed at some depth in the methodology chapter of this thesis.

2.13.4 Current Developments in Personal Epistemology Research

By contrast to the 'established' models of personal epistemology, a recent development challenging all previous conceptions is Hammer and Elby's (2002) framework based on the premise of personal epistemology as a context-activated resource system. Aspects of this model have already been alluded to, but it should be noted this model is underpinned by a shift in ontological perspective from a unitary developmental-trajectory type towards a multi-dimensional beliefs-as-resources model, also encompassing social epistemology. This was a major shift of focus in personal epistemology research, but the framework was not used as a basis for the current study because of the limited focus on school children (Louca *et al* 2004) and trainee teachers (Niessen 2007). Niessen (2007) has adopted a constructivist and enactivist approach to teacher education study which has resonance with Hammer and Elby (2002) and Louca *et al* (2004) claiming a more dynamic and contextualised view of personal epistemology. A challenge to these claims is presented by Greene *et al* (2008) who propose a model built on both developmental and systems lines of research using more advanced statistical techniques derived from latent profile analysis and structural equation modelling. Whilst this still has a firm footing in the positivist camp, it does represent a possible path towards unification of ideas from quantitative and interpretivist research.

2.13.5 Summary

It is difficult to respond to certain aspects of the criticism raised in the above discussion without taking a polar stance on the most appropriate methodology and methods to explore personal epistemology. In response to these criticisms, a pragmatic stance as advocated by Schommer (1993b) is taken, where this research into student nurse personal epistemologies uses the most appropriate frameworks, methodology and tools currently available. Therefore, this research sets out to combine elements from both quantitative and qualitative methods to address these criticisms.

2.14 Relevance of Personal Epistemology to Contemporary Nursing Knowledge

Relationships between personal epistemology and student approaches to studying can be made with accepted conceptions of how knowledge is situated in nursing theory and practice. An individual's personal epistemology will affect how they perceive different forms of evidence that build into the field of knowledge that informs practice. Patterns of knowing in nursing (Carper 1978) are one of the fundamental and well-established conceptions of knowing in nursing literature. They have deeply influenced nursing theorists (Johns 1995, Berragan 1998, Bonis 2009), although the universal acceptance of Carper's (1978) typology has been almost without criticism (White 2004) despite the final caveats in Carper's (1978) paper that the patterns could be subject to change and revision. One criticism relevant here was offered by Silva *et al* (1995) who raised the point that the patterns are presented as an endpoint. Questions about how one might reach those endpoints remain unanswered by Carper (1978), that is, how you might come to know, which is relevant to the subject of this study.

2.14.1 Patterns of Knowing and Personal Epistemology

Developments of the patterns beyond Carper's (1978) original conceptions have been orientated toward how they might be put into action in practice (Chinn & Kramer 1999) and the most significant addition was an overarching socio-political dimension (Heath 1998). This inclusion was justified as a means to include social policy,

professional issues and essential for understanding other patterns. The patterns have been assimilated into nurse education and permeate clinical practice through their inclusion in reflective practice (Johns 1995).

Carper (1978) categorized the forms in which nurses 'know' into four patterns to which Munhall (1993) added a fifth, unknowing, and Silva *et al* (1995) a sixth, the inexplicable, included here because of relevance to the model of personal epistemology and nurse education:

- Empirics – nursing science.
- Aesthetics – nursing as art.
- Personal knowledge – knowing of (one)self.
- Ethics – knowing that informs and justifies moral decision-making and obligation in a nursing context.
- Unknowing and inexplicable – awareness of what is not known and what cannot be explained about clients and other patterns of knowing.

These types of knowing are regarded to be the ontological foundation of nursing arising from subjective, rather than objective, knowledge.

2.14.2 Integrating Personal Epistemology

In order to visualize how personal epistemology could potentially be integrated into a model of nursing knowledge within the bounds of this thesis, a personal conception is proposed in which the patterns of knowing are regarded as pillars of a temple which support the upper structures, the frieze and roof of the temple of nursing knowledge (figure 2.3). This temple is built on broad foundations, of which the steps, representing pathways of education or learning, form a visible and tangible part of the structure.

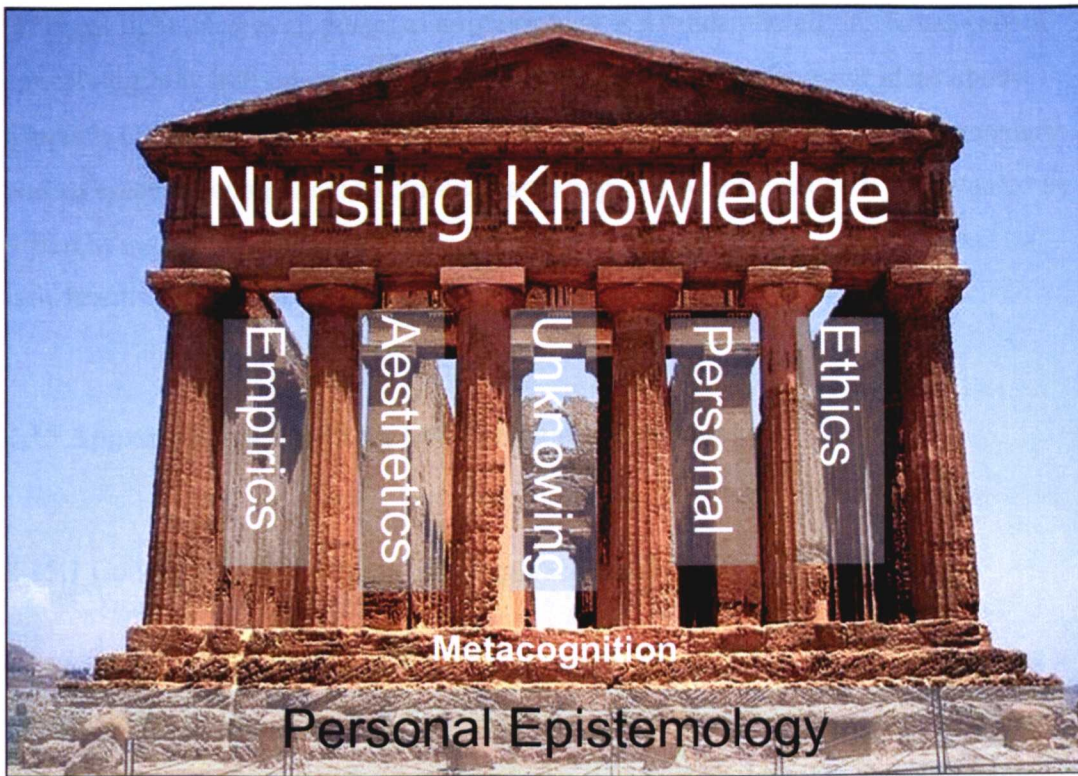


Figure 2.3: Diagrammatic representation of the relationship of personal epistemology to patterns of knowing in nursing.

Different routes up the steps and between the pillars can be thought of as representing approaches to learning, or learning styles. By comparison to these visible components, personal epistemology could be considered to form the fundamental basis of the structure, the hidden and buried blocks of the foundations which extend into the surrounding cognitive landscape on which the footings of the foundations sit. As yet, it is not known how metacognition relates to personal epistemology (Hofer & Sinatra 2010) although it is likely they will be linked in a unified model in future (Greene *et al* 2008).

Although there is a risk that this visualisation of how these complex entities could be conceived is an oversimplification and possibly overstates the importance of personal epistemology, it is useful to demonstrate how it might be conceived to fit with nursing knowledge. It should be emphasized that this is a personal construction presented here as an heuristic aid to understanding and others may regard these constructs in a

different light. However, personal epistemology is a fundamentally different way of conceiving how individuals view knowledge and is outside of current ideas about Carper's (1978) patterns of knowing, but it could be argued it is also complementary and an essential component to our understanding of how knowledge is constructed by different individuals during learning processes. The next sections will elaborate on how learning and personal epistemology are connected.

2.15 Approaches to Learning and Personal Epistemology

2.15.1 Conceptions of Learning and Approaches to Learning

In the introduction, it was stated this research is concerned with learning, and more specifically learning styles and their relationship to personal epistemology. Student approaches to studying can be thought of as a subset of the learning styles literature as previously discussed (Coffield *et al* 2004). The deep and surface approaches to learning in Prosser and Trigwell's (1999) model have foundations in Säljö's (1979) developmental hierarchy of student conceptions of learning. This is a staged or nested model of views of learning, the development of which paralleled Perry's Positions of Intellectual and Ethical Development (1970) discussed later in this chapter:

1. Learning brings about a quantitative increase in knowledge (knowing a lot);
2. Learning is memorising (storing information for easy recall);
3. Learning is about developing skills and methods, and acquiring facts that can be used as necessary;
4. Learning is about making sense of information, extracting meaning and relating information to everyday life;
5. Learning is about understanding the world through reinterpreting knowledge;
6. Learning has a dimension about transforming as a person;
7. Learning as changing the person and the world.

The sixth category was added from a phenomenographic study by Marton *et al* (1993). The more life experience a student has, the more likely they are to view learning as an internal, experience-based process, as in steps four and five, rather than

as an external process as in steps one through three (Säljö, 1979, summarised in Banyard 1994). Trigwell *et al* (2002) proposed the addition of a seventh conception of learning as changing the person and the world; learning is seen a process of invention, the meaning of a learning object is refined through the learning process in which the individual is engaged.

Entwistle and Walker (2002) have proposed that the two areas are connected and portray them as similar phenomena and as systems operating in parallel with each other (figure 2.4). This is important support for the argument presented here because Entwistle and Walker (2002) serve to legitimise the research question of this study to explore relationships between the two areas. Entwistle and Walker's (2002) linkage of the conceptions of learning to Perry's (1970) Positions of Ethical and Intellectual Development could be extended to include Belenky *et al*'s (1986) feminist model, Women's Ways of Knowing. The later conceptions demonstrate a change in the learner in relation to knowledge and a transition from naïve to more sophisticated positions, which can clearly be linked to models of development and maturation of belief systems in personal epistemology, such as Schommer (1990).

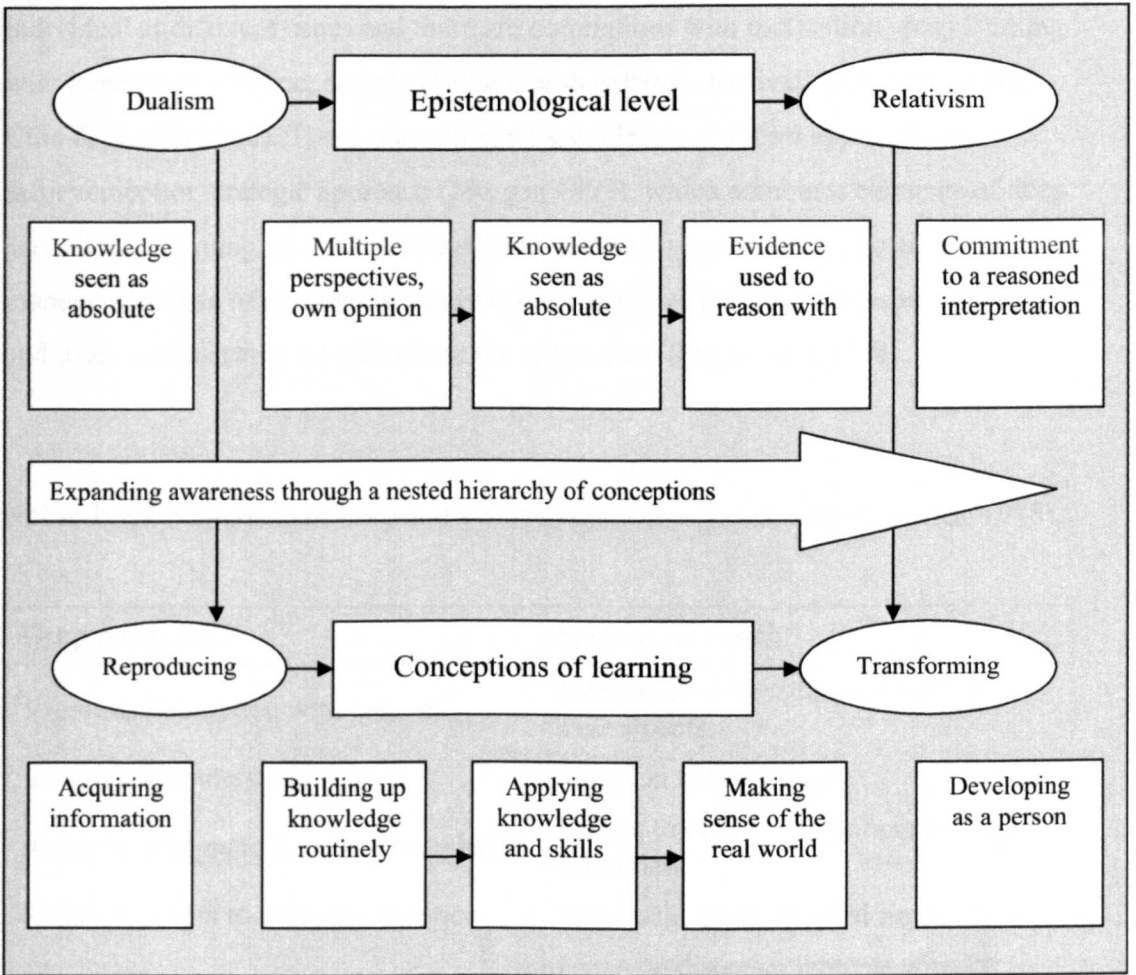


Figure 2.4: The relationship between personal epistemology according to Perry (1970) and conceptions of learning (Entwistle and Walker 2002).

2.15.2 Links Between Personal Epistemology and Approaches to Studying

Further connections can be drawn between student approaches to learning (Marton & Säljö 1976, Gibbs 1992, Beattie *et al* 1997) and personal epistemology. The deep and surface learning approaches summarised in table 2.4 directly relate to the categories in the hierarchy above; 1-3 to surface learning and 4-5, to deep learning approaches. This dualism again echoes Perry's (1970) work (and that of Ryan 1984), but there is more complexity here than is at first apparent; one approach may be more appropriate at different times and in response to different contexts (Beattie *et al* 1997), which echoes the idea of contextually activated epistemological resources (Hammer & Elby 2002, Niessen 2007). Deep and surface approaches might be used by the same

individual at different times and there are correlations with motivation, deep learning with internal or intrinsic, surface learning with extrinsic motivation (Murray 1986, Chin & Brown 2000). There is accumulating evidence of a third approach, an achievement or strategic approach (Morgan 1993), which combines elements of deep and surface learning such as an intention to get the highest grades, effective time management, use of appropriate study materials, use of previous assessment strategies and tools, and alertness to cues about the assessment (Meyer *et al* 1994).

Table 2.3: Comparison of deep and surface approaches to learning (Entwistle 1988).

Deep Approach	Surface Approach
Vigorous interaction with content	Memorise information needed for assessments
Intention to understand	Intention to reproduce
Relate new ideas to previous knowledge	Failure to distinguish principles from examples
Relate concepts to everyday practice	Treat tasks as an external imposition
Relate evidence to conclusions	Focus on discrete elements without integration
Examine the logic of the argument	Unreflective about purpose or strategies

Approaches to learning are not meant to be regarded as individual traits or characteristics as such, but represent responses to specific learning tasks or contexts, such as assessment demands, by the learner. Furthermore, they are not intended to be sequential or hierarchical and one approach is not necessarily 'better' than another (Ramsden 2003), therefore, changes in teaching should be aimed at improving learning experiences or challenges, rather than trying to influence change in the students themselves.

2.16 Criticism of the Conceptual Basis of Student Approaches to Learning

2.16.1 Criticism of the Methodological Approach to Student Learning Research

Critique of the concepts underpinning deep and surface learning approaches has arisen from different perspectives and is concerned with reconciliation with the past, the power of the deep and surface metaphor and the underpinning nature of the phenomenographic approach on which the deep/surface conceptualisation is based (Webb 1997). It is argued that deep and surface learning constructs were a product of their times, grounded in and arising from educational practices of the 1970s and 1980s. During this period, there was an expansion of academic educational development units which strove to legitimize teaching and learning research. This developed from what was regarded as a qualitative perspective, but could instead be viewed as a means to provide positivist generalization and justification for seeking the legitimacy of the field. As a result, the orthodoxy of the deep and surface learning metaphor was 'appealing, acceptable, practical and generalisable' to all disciplines; pursuing the deep approach to learning was 'good' (Webb 1997).

Phenomenography is criticized for being an underdeveloped worldview without the complexities of phenomenology. Moreover, it is seen as being a means to sort out the desired findings into desirable 'correct' categories with the undesired findings discarded (Webb 1997). In what is termed as 'authorised' educational research, for example Marton (1986), students demonstrating undesirable characteristics may be helped to the desired 'correct' view. This raises questions about authenticity and credibility and the phenomenographic researcher is criticised for reconstructing theory in the light of interviews. This line of critique is countered by Entwistle (1997) who takes a pragmatic stance and points to the empirical evidence that has accrued to the benefit of educational activity. Also, it is reasserted that the deep/surface approaches metaphor was not intended to be used as a dichotomous label, but should be seen as learner responses to the particular demands of a course at a particular time. More importantly for the context of this thesis, it is contended by Entwistle (1997) that the benefits for training lecturers is through promoting student-centred teaching with

concern for the individual in a readily accessible way as advocated by Prosser and Trigwell (1999).

2.16.2 Relevance to Higher Education

In criticism of approaches to studying research Haggis (2003) has claimed that the deep/surface metaphor is a paradoxical normative view when critiqued in light of later evidence. The dichotomous distinction favours an elite view of higher education, rather than telling us anything about the majority ('the masses') of students in universities today. Haggis (2003) also points out that research into approaches to studying has been strengthened following funding from the UK Economic and Social Research Council (ESRC) Teaching and Learning Research Plan in 2000 (Entwistle *et al* 2002). It is argued this restricts focus into student learning onto a narrow area. Debatably, a key point is raised when Haggis (2003) questions the meaning of the 'seeking meaning' subscale in the deep approach questionnaire items. This could be viewed as discipline-specific, arising from interest in a subject and a desire to relate knowledge to personal experience. However Haggis (2003) argues it is just as likely to be imposed by the lecturer who both delivers teaching and then is responsible for the assessments.

In an examination of the diversity of concepts underpinning study strategy inventories, Entwistle and McCune (2004) raise the issue that one area lacking is emotion in learning. There are often items that explicitly focus on failure or anxiety (see ASSIST items in the 'fear of failure' subscale), whereas some of the items in the deep subscales implicitly hint at 'enjoying' academic work. This issue is not pursued much further than this, and Entwistle and McCune (2004) quickly avoid further debate by suggesting inclusion of more items would be a threat to parsimony. They suggest 50 items is probably the maximum acceptable length for an inventory taking around fifteen minutes to complete. They do not go as far as to indicate that the issue of subjective emotions about academic studying could be an area for further investigation, but it does appear an area ripe for exploration through qualitative research.

2.16.3 The Self-Report Problem

Finally, Richardson (2004), whilst reviewing the Approaches to Study Inventory (Entwistle & Ramsden 1983), and Study Process Questionnaire (Biggs 1987), urges careful questioning of how validity and reliability of these self-report instruments is measured. The internal consistency of the subscales of the ASI and SPQ were assessed using the conventional Cronbach's alpha as a reliability estimate (Cronbach 1951), and varied from 0.2 to 0.8; values below 0.6 are regarded as poor (Nunnally 1978). In the assessment of the ASSIST, which was designed to provide a 'fix' for the shortcomings of the ASI, Tait *et al* (1998) indicated some subscales had coefficient alphas in the lower bounds in all items, for example, syllabus boundedness 0.55 (surface), use of evidence 0.53 (deep) and organized studying 0.54 (strategic). Thus, the redesigned inventory has particular systemic issues that require treating with caution by prospective researchers. However, all research (possibly with the exception of unobtrusive methods) is open to issues of how respondents react to particular forms of investigation.

2.17 Approaches to Learning Research in Nurse Education

There is some evidence of research into learning approaches in nurse education using instruments to evaluate deep and surface learning. These include Cowman (1998) who used the Approaches to Learning Inventory (ATL - Entwistle & Ramsden 1983) with 1005 students in Northern and the Republic of Ireland and Snelgrove and Slater (2003) and Snelgrove (2004) using Biggs' (1987) Study Process Questionnaire (SPQ) with 289 CFP students in South Wales.

Further studies based on learning approaches inventories include Mansouri *et al* (2006) who used a translation of ASSIST with 230 Iranian nursing and midwifery students and Leung *et al* (2008) who used the Revised Study Process Questionnaire (R-SPQ-2F) (Biggs 2001) in Hong Kong with 116 diploma and baccalaureate students. These studies have used alternatives to, or a translation of, the Tait *et al* (1998) Approaches and Study Skills Inventory for Students (ASSIST).

2.18 Approaches to Studying Research in Nurse Education

2.18.1 Student Nurse Approaches to Studying

The only published research study using the ASSIST (Tait et al 1998) with student nurses was reported by Mansouri *et al* (2006). They used a Persian translation of the ASSIST to study 186 nursing and 65 midwifery Iranian baccalaureate students to compare approaches to studying to grade point average (GPA). The majority of nursing students ($n = 112$; 64%; $\alpha = 0.78$) indicated a deep approach to learning, 39 (22%; $\alpha = 0.80$) a surface approach and 23 (13%; $\alpha = 0.78$), a strategic approach. The percentage of students indicating a strategic approach increased with years of study. Students who reported a strategic approach had the highest GPA which does raise questions about a deep approach being the more desirable study strategy.

However, this study could be criticised for the use of ANOVA for comparisons of approaches when the numbers of students in each group were unequal and, in addition, no effect sizes were reported. Whilst ANOVA is regarded as a robust test (Field 2005), there is no acknowledgement here that there were four times the students in the deep group compared to the surface group. This is important when the subscales scores are considered where the student groups dwindle to as low as 6 and as high as 41 participants. These issues of method aside, though the study indicated six out of ten students adopted a deep approach to their studies, one in five indicated a surface approach. There was little indication of context of student studying or explanation of why these study approaches were indicated beyond time pressures as the course of study progressed.

2.19 Conclusion: An Eclectic Model of Approaches to Studying and Personal Epistemology

In order to demonstrate and analyse how personal epistemology is related to approaches to learning an adapted form of the 3-P ‘presage-process-product model’ (Prosser & Trigwell 1999) is presented in figure 2.6 as a construct to illustrate how these elements may be related as a whole. This is an adaptation of the original Prosser and Trigwell (1999) model reviewed earlier in chapter one with modifications proposed by Duff *et al* (2004) and Schommer (1990) to include personality factors, gender and age re-emphasised as influences (presage) on indicated approaches to studying (approach).

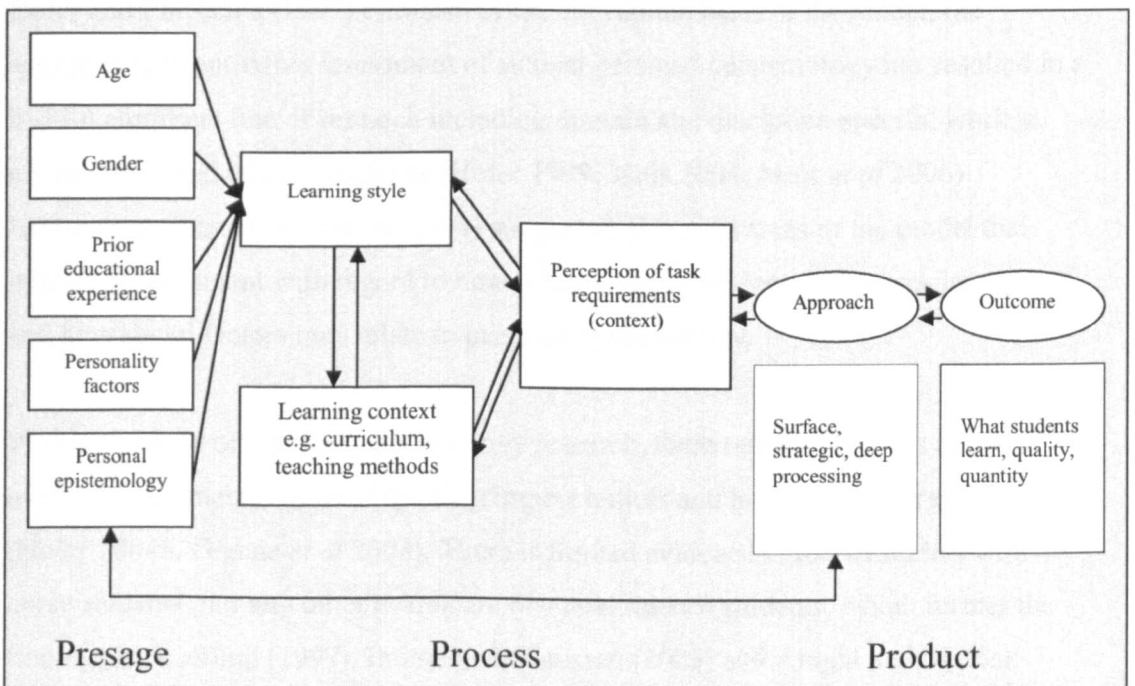


Figure 2.5: Proposed modified presage-process-product model of student learning after Ramsden (1992), Prosser and Trigwell (1999) and Duff *et al* (2004).

Personal epistemology has been added as a proposed additional presage influence, expanding the factors formerly grouped together as student characteristics. By personal epistemology, Schommer’s (1990) independent Belief System Model is the

main element, but it is possible that further elements could be included, for example the position of silence from *Women's Ways of Knowing* (Belenky *et al* 1986). The whole model is useful for considering creative ways of modifying each factor with the potential to enable prediction of possible results in practice.

2.20 Chapter Summary

Personal epistemology research has been an area of increasing research interest and rapid development because of questions about how epistemological beliefs influence student learning. Schommer's (1990) independent beliefs systems model is presented as an important development for teaching because it links personal epistemology to issues important to academic learning which include performance and attrition (Schommer 1990, 1993a, 1993b, Schommer-Aikins *et al* 1997, Muis 2004). Despite Hofer and Pintrich's (1997) criticism of the conceptual basis of the model, the approach to quantitative assessment of student personal epistemology has resulted in a fruitful empirical line of research including domain and discipline-specific work in mathematics and other disciplines (Hofer 1999, Muis 2004, Muis *et al* 2006). However as Schommer-Aikins (2004) suggested, there are areas of the model that require development with regard to how personal epistemology influences learning and how social factors may relate to personal epistemology.

Within the field of personal epistemology research, there remain vigorous debates over the fundamental form of epistemological beliefs and how they are organised (Hofer 2004b, Greene *et al* 2008). There is limited evidence in recent studies with nurse students, nor any other healthcare or social science students, which further the findings in Aquilino (1997), Bråten and Olaussen (2005) and Knight and Mattick (2006). Yilmaz and Kaya (2010) offer fresh insight into the form of student nurse personal epistemologies, but debatably the study is flawed as a result of major adaptations to the questionnaire. Further knowledge of pre-registration nursing student personal epistemologies is therefore relevant and timely, particularly as UK nurse education has moved into all graduate entry and award. In parallel with personal epistemology research, an increasing body of learning styles literature has arisen concerned with individual student differences with regard to either approaches to

studying or personal epistemology, but few studies address both areas. Personal epistemology provides a novel perspective on influences on student learning especially the relationship to study approaches is examined.

This chapter has laid out the arguments for the research questions as being an area of study valid and relevant to nurse education practice and one in which there is a dearth of discipline-specific literature. It is intended that the methodology and methods adopted for the survey will reveal new insights into how nurse students approach their studying and how their personal epistemologies may influence or be related to their learning styles. The methodology and methods are presented in the next chapter.

Chapter Three

Methodology and Methods

3.1 Introduction

The introduction and literature review have examined the constructs of personal epistemology, student approaches to studying and have established their relevance to nurse education. It has been demonstrated that there has been limited research into student nurse approaches to studying and very few nurse education studies concerned with constructs from personal epistemology literature or research, let alone the beliefs systems model (Schommer's 1990) focused on here. Key questions remain to be answered in the field as a whole with regard to how beliefs are organised and how they can best be studied with the aim of producing a unified model.

A mixed methods research design was commensurate with the aims of researchers who study nursing practice and education who are interested in the whole person, community and environment (Morse & Niehaus 2007). Quantitative survey methods were used to gain a 'snapshot' of student nurse personal epistemologies and approaches to studying. Qualitative interpretative methods were adopted and adapted to add nurse education-specific context and description of social processes to the general epistemological beliefs and studying approaches data from the questionnaires. In terms of this research, I was interested in the students both as individuals and as a community within the institution of higher education.

The nurse students in this study were enrolled on the undergraduate degree programme at the School of Healthcare Science, Bangor University in North Wales. Students attended one of which had two school sites, one within the university town itself which was in a rural setting and one in an urban setting close to a large district general hospital in North East Wales. The School offered pre- and post registration nursing, radiography, operating department practitioner and occupational therapy courses and masters and doctoral level programmes of study. At the time of this study the School was one of two providers of pre-registration nurse education in North Wales in partnership with the three local Healthcare Trusts which later amalgamated

into one Health Board. Each Trust comprised a large district general hospital and several smaller community hospitals and clinics that stretched across North Wales where students were placed for clinical experience. The student nurses were mainly female and the majority on pre-registration programmes were under twenty five years of age although there were a significant number of students who were over 35.

This chapter, therefore, provides the pragmatic philosophical underpinnings of this study and the justification and rationale for the design and use of particular data collection methods. In order to provide clarification of terms at this point, 'methodology' refers to an epistemological position and 'method' to the techniques of collecting and analysing data (Bryman 1984). 'Paradigm' refers to the set of fundamental beliefs that guide research actions (Denzin & Lincoln 1994) and encompass epistemology, ontology, axiology and methodology.

3.2 The Research Questions and Methodological Approach

It is worthwhile reiterating the research questions prior to presenting the case for the methodology and the specific research design in this study:

- What are the characteristics of student nurse personal epistemologies?
- What are the relationships between student nurse personal epistemologies and their approaches to studying?

In addition, it was hypothesised that students who indicated more sophisticated epistemological beliefs, that is knowledge is complex and evolving and they were able to change as learners, would also indicate deep approaches to study.

3.2.1 Methodological Framework and Issues of Ontology and Epistemology

A pragmatic philosophical stance was used to answer the research questions and resolve the methodological issues arising from the use of methods from quantitative and qualitative paradigms. Pragmatism has been linked to mixed methods research for

education and nursing (Howe 1988, Greene *et al* 1989, Teddlie & Tashakkori 2003a), thus legitimising it as a paradigm and philosophical stance suitable to underpin this study. Mixed methods research designs provided structure for the investigation of the study's research questions (Teddlie & Tashakkori 2003a, Johnson & Onwuegbuzie 2004, Morse *et al* 2006, Creswell & Plano Clark 2007).

3.2.2 The Pragmatic Paradigm

The pragmatic approach raised the spectre of the quantitative and qualitative 'dichotomy' which pervaded nursing and education literature in the 1980s and 1990s (Duffy 1985, Howe 1988, Gage 1989, Jones Porter 1989), despite calls for an end to the debate and the incompatibility thesis (Howe 1988). There has been an evolution from divergent and implicitly gender-laden viewpoints about the nature of science, echoing Perry's (1970) naïve and dualistic intellectual developmental stages, to more relativist and considered positions (Carr 1994, Clark 1998, Duffy 1985, Sale *et al* 2002, Badley 2003). Although the quantitative-qualitative debate has been described as sterile (Rycroft-Malone *et al* 2004), the use of methods associated with different paradigms meant the issues raised by the use and integration of those methods needed careful consideration at all stages of the research process in this study. Each paradigm has well-documented differences and evaluate phenomena in fundamentally different ways, even when they are purported to address the same area of study (Duffy 1985, Sale *et al* 2002).

To overcome the paradigm differences, data collection methods and results can be legitimately combined if the aim is complementarity. This recognises that complexity and contradiction exist and that differences may be as informative as the similarities in results or findings (Brannen 1992). Complementarity allows for the possibility that inconsistencies may occur and is not solely concerned with countering strengths and limitations of different methods and their associated findings, which is implied by triangulation (Sale *et al* 2002). Sandelowski *et al* (2009) refers to 'conditional complementarity', used as a means for interpretation of the results from quantitative studies, rather than compensating for a lack of complexity, voice and discourse. This

perspective is important because it would be tempting to regard the qualitative component solely as a means of providing validation.

Pragmatist researchers regard the research question as the most important issue, over and above methods or paradigm (Johnson & Onwuegbuzie 2004). The unique contribution offered by mixed methods research is to open up inquiry to all possibilities, but tied to practical ends. That is, it can be used to obtain a workable solution to a problem or issue, even if it might be criticised as philosophically imperfect (Maxcy 2003, Johnson & Onwuegbuzie 2004). All research methods are viewed as useful, thus the incompatibility thesis can be rejected (Howe 1988), and it is recognised that research takes place in multiple arenas including social, historical, political and cultural contexts. These influences are acknowledged in this thesis as an effect on the purpose, context and recommendations derived from the study.

In a critique of research founded in pragmatism, the question is asked for whom the results are useful (Mertens 2003), which is important in this study because of the relationship with the student participants. The nature of relationship is discussed in later sections of this chapter, but it should be apparent from issues raised earlier that the findings had the potential to be useful for both students and teachers in the context of nurse and higher education because it examined an unknown area. It has also been argued that pragmatism justifies a greater focus on applied rather than basic research and that research grounded in this philosophical basis will only promote incremental, as opposed to radical change in society (Johnson & Onwuegbuzie 2004). In nurse education it is arguable as to whether radical change is a desirable effect of research or a requirement for undertaking it. The question of using research to change practice and policy is alluded in the introduction to this study. One aim of this research was to produce recommendations that would influence teaching activity in the school and be disseminated into the wider nurse education community.

In addition to questions about the solution and usefulness in promoting change, the quest for inclusivism with regards to paradigms and methods has led to criticism of mixed methods as 'positivism dressed in drag' (p198) and a subversive post-positivist means to 'endanger' (p198) the diversity of qualitative methodologies (Giddings 2006). A criticism of this study could be that mixed methods research produces output

limited because as an approach, it is adopted as a token gesture and there is a lack of integration of data and results:

A design is set in place, a protocol followed. In the main, the questions are descriptive, traditional positivist research language is used with a dusting of words from other paradigms, and the designs come up with structured descriptive results. Integration is at a descriptive level. A qualitative aspect of the study is often 'fitted in'. The thinking is clearly positivist and pragmatic. The message often received by a naive researcher, however, is that mixed methods combines and shares 'thinking' at the paradigm level.

(Giddings 2006, p200)

However, the qualitative component was not just superficially 'fitted in' or an add-on, but was intended to be integrated with the quantitative results during the analysis and interpretation stages of the research process using a recognised design, thus countering Giddings (2006) assertion that the end product would be 'structured descriptive' output. The issue of how integration was approached will be addressed in the next sections of this chapter which examine the research design in greater detail.

3.3 Study Design: Theoretical Drive

A mixed-methods design with an overarching deductive theoretical drive directed this project. A QUAN → qual sequential research design was adopted following the recognised typology and notation of mixed methods research (Morse *et al* 2006). To clarify the terminology and notation used in the context of mixed methods studies, 'project' refers to the overall study, and 'component' to each phase of the project. 'QUAL' and 'QUAN' indicate the dominant component, '+' a simultaneous design, and '→' a sequential design (Morse 2006). Key principles of mixed methods design were applied in this research project (Morse 2003):

- Recognise the theoretical drive of the project;
- Recognise the role of the imported or supplementary component of the project;
- Adhere to the methodological traditions of the dominant method;
- Employ as few data sets as possible.

The purpose of the qualitative data collection method or component was to complement the survey results by providing in-depth contextual educational and social framing of issues that the descriptive and inferential quantitative data methods could not provide (Ivankova *et al* 2006). Traditions and techniques underlying the quantitative and qualitative methods were as rigorously adhered to as possible, permitting exploration and critique of the survey results and instruments used in the study alongside an interpretivist exploration of the student social experience of personal epistemology and approaches to studying. Various permutations of designs were considered, for example a simultaneous QUAN + qual project, but this design was rejected because it would restrict the use of the quantitative results to inform the grounded theory data collection and analysis.

Further consideration of the role of the supplemental qualitative component raised important questions about the exact relationships with the quantitative component. Morse *et al* (2006) regard the qualitative component in QUAN → qual designs as an adjunct to the main data analysis that should not be intended as a stand alone or complete study and the data can be subject to ‘quantitisation’ following coding (Sandelowski 2000). Data transformation was not undertaken because this procedure remains somewhat contentious and a possible route to violating Morse’s (2003) advice to adhere to the traditions of the dominant theoretical drive. Arguably, grounded theory codes and categories could lend themselves to quantisation but this is an area where methods are still maturing (Sandelowski *et al* 2009).

Switching between inductive and deductive drives during the course of the project is a legitimate activity (Morse 2003), referred to as abductive thinking, but, in terms of validity, it affirms the importance of the need to constantly question whether the overall purpose of the project is to build theory or to test theory. There are no QUAN or QUAL QUAL designs in Morse *et al* (2006), which contrasts with designs in Teddlie and Tashakori (2003b) who class these co-dominant method studies as ‘multimethod’ designs and Creswell and Plano Clark (2007) as triangulation designs; for the purpose of this study, the nomenclature and typology of Morse *et al* (2006) is adhered to, and thus, the overall assumption that a dominant component underpinned the theoretical drive; in this study, the quantitative component.

Cresswell *et al* (2003) and Cresswell and Plano Clark (2007) offered additional guidance about the mixed methods research process and design through highlighting three key areas for consideration:

- Timing – the implementation or the order in which the data are used;
- Weighting – concerned with emphasis on the methods employed for data collection;
- Mixing – the explicit decisions made regarding how data will be mixed.

The design description indicated the chronological sequencing of the main components of the study, but there was some scope for overlap and integration of those components prior to analysis. The pilot study results influenced the development of a semi-structured interview schedule and they were clearly present and influential as foreshadowed questions (Rodwell 1998) informing the grounded theory study. The weighting was also clear in the QUAN → qual design, but, again, this was wrestled with in reality, because both arms of the study had their strengths and limitations, although the design was primarily deductive as stated previously.

3.3.1 Complementarity vs. Triangulation

Issues raised by the data collection, mixing and integration techniques led to the question of whether this design was a triangulation approach. Triangulation is defined as the use of multiple data sources all with a similar focus, or a combination of (or multiple) methods to achieve confirmation of findings and ‘completeness’, or understanding of the domain (Begley 1996). Furthermore, Denzin and Lincoln (1994) suggest the purpose of triangulation in qualitative research is to ‘secure an in-depth understanding of the phenomenon in question’ and, although this does not equate to validity, it is a means to add credibility and rigor. From a mixed methods perspective, Teddlie and Tashakkori (2003b) question whether triangulation is a word over-used ‘to the point where it means nothing’ and Sandelowski (2003) suggests we should be cautious about using triangulation as a descriptor too liberally and without careful justification:

When any kind of research combination is designated as triangulation, there is no inquiry that is not triangulated. Having too much meaning, the word triangulation has no meaning at all... Triangulation appears as a 'near-talismanic' method (Miles & Huberman 1994 p266) for democratising inquiry and resolving conflicts between qualitative and quantitative inquiry.

(p328)

Complementarity as a purpose for mixed methods research is defined as a means to provide breadth and depth to a study by accessing different perspectives on a phenomenon, including recognition that it could result in divergent and convergent findings (Sale *et al* 2002, Greene 2007). Morse (2003) asserts quantitatively-lead QUAN →/+ qual mixed methods projects have a tendency to be mainly focused on a single method and therefore triangulation is an inappropriate descriptor of the mixed methods design because the supplemental study may provide 'only a glimpse of another perspective'.

The criteria of purpose for using mixed-methods designs (Greene *et al* 1989) (summarised in table 3.1) provide alternative rationales to triangulation for the use of an explanatory mixed methods. The criteria for using mixed methods add an extra layer of explanation of the purpose of the design in this study to counter Sandelowski's (2003) criticism. These criteria were intended as drivers and/or outcomes of this study and were seen as a means to counteract threats to validity and rigour. The data collected throughout the study were intended to be used for purposes of initiation, development, expansion and to enhance significant findings. Initiation and development occurred during and after the survey data collection and analysis and informed the derivation of a semi-structured interview schedule. Methods for achieving the latter two of these purposes, expansion and enhancement are discussed in the next section, which focuses on how data integration was achieved.

Table 3.1: Purposes of mixed methods research (Greene *et al* 1989).

Purpose	Rationale
Triangulation	To corroborate results using combination data collected through different methods.
Complementarity	To seek elaboration, illustration or administered surveys about clarification of the results from one method with the data collected from the other method.
Initiation	New research questions can arise from the use of methods from one paradigm and be further investigated using techniques from another.
Development	These studies are sequential designs where the data from the initial data collection informs the development of the subsequent method.
Expansion	To extend the depth and scope of the enquiry by using different measures to explore different enquiry components.
Enhancement of significant findings	Significant findings from one method of data collection can be specifically explored by another data collection method thereby enhancing the findings.

A visual model of the overall mixed methods design and procedures used in this study is represented in figure 3.1 as advocated by Ivankova *et al* (2006).

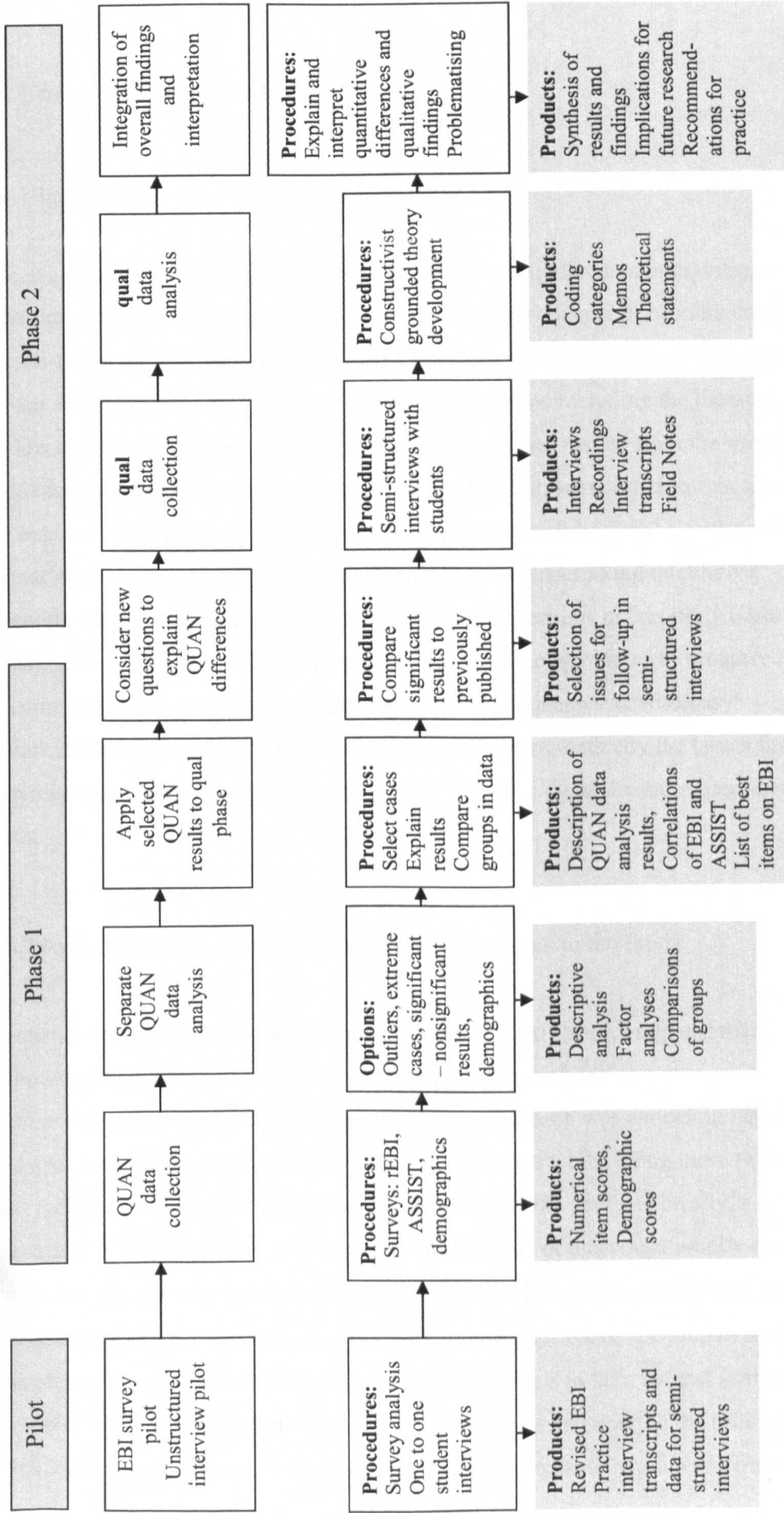


Figure 3.1: Visual representation of data collection and analysis procedures (after Cresswell & Plano-Clark 2007).

3.4 Grounded Theory Methods

3.4.1 Introduction

The sequential qualitative component of the study was undertaken both during and after the quantitative data analysis. The grounded theory data collection method used person-to-person focussed semi-structured interviews with a purposive theoretically-driven sample of students. Elements drawn from sources including the literature review combined with categories from the pilot study and results from the survey influenced the design of the interview schedule. The semi-structured format allowed for exploration of issues as they arose. The appropriateness of using a constructivist grounded theory approach was justified by criteria for undertaking qualitative research, commensurate with the aims and research questions in this study (Cresswell 1998). Grounded theory was a means to look at 'ordinary problems of ordinary folk', to enter the worlds of the participants and make the ordinary 'extraordinary' (Charmaz 2006b). It provided a chance to scrutinise systematically the issues that had provided impetus for the research and present them in a dynamic and student-centred form.

3.4.2 Appropriateness of the Grounded Theory Approach to the Study

Constructivist grounded theory methods (Charmaz 2000) employing analytical techniques from Strauss and Corbin (1998) and Charmaz (2006a) were used to address the research questions. The constructivist approach was appealing because it was procedurally less rigid and less reliant on technique whilst being more reflexive than the approach espoused by Strauss and Corbin (1998). Philosophically, a constructivist approach was in alignment with the aims of this educationally-focused research as discussed previously (Prosser & Trigwell 1999). Charmaz (2000) asserts constructivist grounded theory can bridge traditional positivistic techniques with interpretative methods and reaffirms studying individuals in their natural setting. It is concerned with ordinary situations, issues and problems and making the ordinary extraordinary through questioning meaning in the participants' worlds and making

them explicit (Charmaz 2006a). Data are constructed through interaction between the viewed and the viewer and they are not seen to exist separately from either.

Furthermore, the fundamental procedures of grounded theory, such as coding and memo-writing are viewed as heuristic strategies and methodologically neutral, not purely as positivist prescriptions to be followed fastidiously.

This approach was appropriate for this study because, as Charmaz (2000) observes, we are not without values, but are part of the world we study. Theory, or meaning, is constructed through past and present involvement with the participants, the study context and the research methodology and methods. Also, at the time of the study, I was in the role of practitioner-researcher (Reed and Proctor 1995) which enabled a close relationship with students, although not necessarily participants, and was essential to present the student experiences in their terms (Charmaz 2000). This relationship had to be reflected on because the interview was a stage where differences in power and status could be acted out and this is the subject of an in-depth examination of these issues in section 2.11.

The constructivist approach contrasts with the original grounded theory objectivist views of Glaser and Strauss (1967) where theory is discovered as it emerges from the data and is separate from the scientific observer-researcher. Constructivist grounded theory is not presumed to be a reproduction or an exact picture of the world being examined, but as an interpretative presentation of one of multiple realities (Charmaz 2006a). Central to this methodology is the production of substantive theory aimed at illustrating processual understanding (Charmaz 2000), rather than exploring causality. This understanding is based firmly in the symbolic interactionism of Mead (1934) that assumes society, identity and meaning are constructed through interactions with others through use of language. Therefore, a constructivist methodology was consistent with the purpose of higher education research as conceived by Prosser and Trigwell (1999). As stated in the literature review, they consider the combined use of quantitative and qualitative methods as a pragmatic means to an end and to be complementary, that is, to promote the describing and understanding of processes in higher education teaching and student learning.

Grounded theory could be further justified as appropriate for this study because it has been widely used for social analysis in psychology, education and nursing (Annells 1996, Benoliel 1996). It is characterised as a system for analysing and interpreting data through simultaneous collection and analysis procedures to explain theory resident in the data. A grounded theory approach (Strauss & Corbin 1998) combined with the constructivist interpretivism espoused by Charmaz (2000) was adopted because there was no existing qualitative study of student nurse personal epistemologies and relationships to their approaches to studying. Furthermore, the requirements for bracketing required by Glaser and Strauss (1967) could be relaxed, thus enabling consideration and integration of existing theory as well as results and issues arising from the QUAN data, an essential part of this mixed methods study. This was a route to enhancing theoretical sensitivity, defined as the 'ability to recognise what is important in data and to give it meaning' (Glaser 1978) and thus made it legitimate to be acquired from the literature, professional and personal experience and the actual analysis process itself.

3.4.3 Grounded Theory: Strengths and Limitations

A strength of the grounded theory approach condoned by Strauss and Corbin (1998) is that it allows for interaction between the researcher as practitioner, their experiences and the world being investigated which further enhances theoretical sensitivity. The main risk is commitment to one specific theory which can then reduce sensitivity (Glaser & Strauss 1967), but that is an influence accepted by Charmaz (2006a). An individual's experience of a phenomenon will differ from the experiences of others and, whilst professional experience might be an advantage, socialisation into the culture of a profession could also mask what could be obvious to someone with fresh vision of a situation. Acceptance of multiple realities is a key feature of Charmaz's (2006a) approach as researchers cannot always ignore experiences and knowledge of the phenomena of interest. This is congruent with Glaser's (1978) idea of 'respected little islands of knowledge' (p148), by which he meant you cannot ignore previous knowledge and do not necessarily need to discover completely novel categories or theory.

Creativity, or the research imagination, is considered to be an important quality the researcher brings to the grounded theory process and use of this quality can be kept rigorous by constantly questioning the data and maintaining an 'attitude of scepticism' towards codes and categories from the data (Strauss & Corbin 1998). By contrast to this scientific approach, Charmaz (2006a) refers to creativity as 'imaginative understanding', which is essential for interpretative theory construction to when move the analysis from descriptive codes to abstract concepts. Also, as stated previously, adhering to the data collection and analysis procedures is a further check against researcher bias and allows for pauses for reflection on assumptions during coding and categorisation of data and theoretical sampling on the basis of emerging concepts and revision of hypotheses as they are developed.

In terms of limitations, the status of the theory constructed by grounded theory studies can be problematic and in education has been criticised on the basis that the methods oversimplify complex meanings and interrelationships in data. This may arise from the importance granted to procedure, rather than interpretation, which is a feature of certain proponents of the method (Thomas & James 2006). Charmaz (2006a) challenges these positivist assertions and justifies the interpretative grounded theory construction by emphasising understanding and the exploration of patterns and relationships, including indeterminacy, rather than seeking causality, which echoes the Prosser and Trigwell's (1999) purpose of classroom-based educational research. This grounded theory is substantive theory, usually addressing a delineated problem or area of study, as in this study. The constructivist perspective in grounded theory is important with regard to limitations, because it attends to the processes of the production and interpretation of the data, as opposed to an objectivist stance, which would regard that same data as real and of itself.

3.5 Data Collection Methods

3.5.1 Sampling Procedures

Prior to providing the rationale for the research methods and details of the procedures, the criteria for eligibility for inclusion in the study and the systems for participant and data protection are described. As previously stated in Chapter One, all data collection methods and procedures were approved by the School Research Ethics Committee (see appendix one for more information).

3.5.2 Participant Inclusion Criteria

The inclusion criterion for participants was current enrolment on the pre-registration nursing degree programme at a specific university school situated across six north-western counties of the United Kingdom. Participants were accessed at two geographically different sites, which will be referred to as site one and site two, and used the same curriculum. Both were located near district general hospitals and large towns. Those students who were not currently enrolled on the pre-registration course were therefore excluded from the study.

3.5.3 Participant Sampling

Survey Sampling Strategy

A non-probability convenience sampling strategy was used (Babbie 2008) and was appropriate for the QUAN component of the study in order to achieve the recommended sample size for factor analysis and subsequent procedures.

Survey Sample Size

There is general agreement that a large survey sample provides more reliable correlations for exploratory factor analysis (EFA) (Tabachnick & Fidell 2007) and that the resulting factor loadings are then a more precise estimate of population factor loadings (MacCullum *et al* 1999). It was initially difficult to determine how large a

sample was large enough, so criteria derived by Mundfrom *et al* (2005) were adopted where minimum sample size is related to the number of variables, the number of factors, the number of variables per factor and the size of the communalities. Communality is the amount of variance in a variable explained by all the factors and is a measure of reliability of that variable (Tabachnick & Fidell 2007). Minimum sample sizes to meet good and excellent criteria for agreement between the population solution and sample population are summarised in table 3.2 for a five factor solution with a ratio of five variables to each factor (EBI items $n = 28$).

Table 3.2: Minimum sample sizes and communalities required for factor analysis (Mundfrom *et al* 2005).

Ratio of variables to factors	Communality	Excellent level criterion (0.98)	Good level criterion (0.92)
5	High	260	130
5	Wide	300	140
5	Low	430	180

High communality: 0.6-0.8

Wide communality: 0.2-0.8

Low communality: 0.2-0.4

(Note: the excellent/good level criteria refer to coefficient of congruence – K)

During the pilot study, it was apparent that the communalities from the EBI were wide, indicating a minimum sample size of 140 participants with 300 being desirable, which was an achievable target when the total number of potential student participants across the two sites was taken into consideration. In the case of ASSIST with 66 items and a ratio of 16 items per each of the 3 factors, the recommended sample according to Mundfrom *et al* (2005) was 40-70 participants, so the sample size required for the EBI was sufficient for the overall survey. The sample size would also be adequate for further inferential statistical procedures such as analysis of variance (ANOVA) or regression (Field 2005).

Grounded Theory Sampling Strategy

The participants for the semi-structured interviews were initially selected from a convenience sample of participants recruited from the student cohorts approached during the quantitative component of the study. This approach was justified because initially there was no specific data to direct theoretical sampling until the pilot study (Chiovitti & Piran 2003).

The recruitment procedure for the qualitative study was carried out by briefly outlining the study in the classroom environment. Students were given access to the information sheet which explained the study and consent form which required the volunteers to provide details of how they would prefer to be contacted and a signature (appendix 3, form 1). These were adapted from the patient information sheet and consent form available from the Central Office for Research Ethics Committees (COREC 2001) and approved by the School Research Ethics Committee. The information sheet and consent form were distributed to students during the survey and made available in a printed format in public student areas of the School and on the student electronic virtual learning system.

3.6 Survey Instrumentation

3.6.1 Questionnaires as a Data Collection Method

Questionnaires were the method used to collect quantitative data quickly and reliably from the student participants through self-completion inventories. They are a reliable means of data collection because the way the questions are presented cannot be varied in any way, although how they are perceived by participants is arguably open to interpretation. This relative reliability and lack of variation in responses permits quick data analysis and comparisons between participants can be made using statistical software which can be generalised to the population of interest (Parahoo 2006).

Surveys are recognised as an effective means of obtaining a large amount of cross-sectional or longitudinal non-experimental data inexpensively (Polit & Beck 2004).

Finally, questionnaires can be piloted prior to a large-scale to improve reliability and can be straightforwardly disseminated for use by other researchers (Parahoo 2006).

The group-administered questionnaire approach was used (Oppenheim 2001), which offered the advantages of rapid administration at predictable and scheduled times and opportunities to answer participant questions about the instruments, although this was limited to issues around completion rather than content or meaning. Also, this procedure made it possible to get information about non-response or non-completion rates.

The principal disadvantages of questionnaires are they are limited to gathering superficial information about respondent attitudes, beliefs or preferences and social processes. In addition, they may separate the behaviour under study from the social, cultural and historic context of the participants (Mechanic 1989). If they have closed response systems, such as the Likert scales in this study, then there is no scope for elaboration of answers or clarification of the questions by the researcher, thus contributing to the issue of question interpretation alluded to previously.

The potential limitations of this self-report instruments used in this study should be recognised. A threat to validity was participant propensity to provide socially desirable responses. This is allied to the inflexibility of instruments when applied to

participants that were from different backgrounds to the original validation sample, with particular regard to issues such as culture and ethnicity. A further limitation was that the instruments were designed to provide a measure of particular predispositions, conceptions of epistemological beliefs (EBI) and studying (ASSIST). This raised the question of how accurate the students' responses are to the items when they are based on retrospective and potentially subjective reconstructions of how they perceive their cognitive processes (Richardson 2004). Finally, group-administered questionnaires raise issues around captive populations, particularly when working with a vulnerable group, and this was a potential source of bias if students felt coerced to participate (Schutt 2006). There is no overall solution to these problems and issues and they will be considered in depth in the section on ethical considerations (3.13).

Reliability and validity are key issues in questionnaire design and relevant to this study. Validity can be addressed by two questions (Parahoo 2006):

- Does the questionnaire answer the research question(s)?
- Do the questions accurately represent the different aspects of the concept under study?

Reliability can be assessed by asking questions of the item content and presentation:

- Are the items clear and unambiguous enough for a participant to give the same response each time they are presented to them (unless they have a different answer to give)?
- And, do participants understand each item the same way as other participants?
- Do all participants understand the instructions given by the researcher in the same way?

The questionnaires used in this study were validated and information about validity and construct reliability was available in published research. This contributed to answering the above questions as far as was known with previous populations. The findings from this research could add to what was known about validity and reliability. The following sections will review the development and validation of the instruments used in this study.

3.6.2 Epistemic Beliefs Inventory Development and Validation

The most recent development of Schommer's Epistemological Questionnaire (1990) was the Epistemic Beliefs Inventory (EBI) (Schraw *et al* 2002), which shortened the EQ to 28 items to produce a reduced item questionnaire with the aim of capturing the all of the hypothesized dimensions in Schommer's (1990) model. The inclusion of items focusing on omniscient authority was regarded as an important development which was needed to reflect beliefs about source of knowledge in research into problem solving. It was hypothesised that higher scores on this factor could reflect the beliefs of an individual who would approach a problem with solutions limited to those of 'experts'. The questionnaire items were derived directly from Schommer's (1990) 63 item EQ with the aim of markedly reducing the number of items into a more manageable, but still factorially acceptable number providing increased acceptability for participants, ease of researcher coding and decreased probability of completion errors.

3.6.3 Questions of Construct Validity

Development of the Schommer's (1990) epistemological beliefs model and the EQ is relevant to the evolution of the EBI and has focused on two main areas:

- Psychometric properties and adaptation of the Epistemological Questionnaire.
- Connections between epistemological beliefs and influences on learning.

The studies summarised in table 3.3 have focused on investigating the core number and composition of the dimensions that make up epistemological beliefs. There has also been a drive to reduce the EQ to a more manageable number of items that will still detect the hypothesised beliefs. Only a few studies have examined translation of the instrument and effects of cultural adaptations.

Qian and Alvermann (1995) questioned the construct validity of Schommer's (1990) model when they attempted to replicate the dimensions from the original study. However, they developed a new instrument adapted from the EQ as part of a package of questionnaires. Ten original items concerned with omniscient authority were

excluded because of Schommer's (1990) previous findings. In addition to omitting those items, Qian and Alvermann's (1995) factor analysis differed to Schommer's (1990) procedures because the final solutions were based on retaining items with coefficient loadings of greater than 0.30. This resulted in the exclusion of 21 of the 53 items, which resulted in a three factor solution combining simplicity and certainty of knowledge.

3.6.4 International Studies

To add to the questions about measurement issues and the underlying nature of the dimensions of Schommer's (1990) model, Clarebout *et al* (2001) used the EQ in studies of European students. What was notable was the participants were all aged 20-22 years, which is a narrow range compared to other studies. Conflicting factor structures were apparent following exploratory factor analysis of subset scores from the questionnaire data.

Clarebout *et al* (2001) emphasise their results should be interpreted with caution because the instrument was translated into a Dutch version. However, failure to replicate Schommer's (1990) factor structures was regarded as a limitation of the instrument and not a result of cultural issues related to the translation. Clarebout *et al* (2001) were critical of Schommer's (1990) statistical analysis techniques with reference to the use of factor score coefficients, which were entered into the factor analysis and subsequent regression procedures. It was concluded that the main issues in research using the EQ concerned the use of a self-report instrument to assess beliefs, the number of factors or dimensions that were present and the lack of consistency in reported analysis of the EQ.

Table 3.3: Summary of studies examining Shommer's (1990) Epistemological Questionnaire.

Study	Sample	Age	Disciplines	Instrument	Factor solution
Jehng <i>et al</i> (1993): University students epistemological beliefs	386 students, freshman to graduates; 146 male, 252 female; random, stratified sample.	Not specified	Engineering (31%), business studies (21%), social science (29%), arts & humanities (19%).	Composite 51 item instrument derived from Schommer's EQ and Spiro <i>et al</i> (1989 in Jehng <i>et al</i> 1993).	Five factors; alpha .84; Four factors matched Schommer, fifth factor labelled 'orderly process'; CFA used to confirm 5 factor model.
Qian & Alvermann (1995): Role of epistemological beliefs and learned helplessness	265 US high school students 112 male, 100 female.	mean age 16 years, 10 months	physical science, biology, chemistry	53 item Epistemological Beliefs Questionnaire; overall scale Cronbach's alpha 0.77.	Item level factor analyses of three through to five factor solutions and resulted in a three factor solution. 'quick learning', 'simple-certain knowledge' and 'innate ability'; eigenvalues ranging from 1.06-3.92 and Cronbach's alpha 0.62-0.79.
Clarebout <i>et al</i> (2001): Assessment of the psychometric qualities of the EQ	189 sophomore students from three universities in the Netherlands & Belgium; 414 sophomores from two universities & two colleges of higher education in Belgium.	20-22 years	Education, engineering, biomedical sciences	Schommer's Epistemological Questionnaire translated into Dutch: two factor alphas .68 & .71; four factor alphas .31-.59.	Four factors were found to be the most parsimonious solution explaining 55% and 50 % of variance respectively. Item level analyses resulted in a two-factor structure for sample one (15% variance) and four-factor for sample two (21% variance).
Cano (2005): Epistemological beliefs and approaches to learning	Secondary school students; 45% female, 55% male; several (unquantified) schools sampled.	12-20 years, mean = 14.8 years		Schommer's EQ; Learning Process Questionnaire in Spanish translations	Exploratory analysis resulted in deep and surface factors, explained 62% of variance, alpha .74 and .47, with CFA confirmation. CFA indicated three EQ factors; quick effortless learning, simple knowledge & certain knowledge.

In a more recent study by Cano (2005), the EQ was used with secondary school students, and three factors labelled 'quick effortless learning', 'belief in simple knowledge' and 'belief in certain knowledge' explained 42% of variance.

Confirmatory factor analysis indicated what were described as reasonable goodness of fit indices, although the chi-square test results were outside of what is regarded as acceptable (Brown 2006). This raises questions concerning the suitability of the data for further structural equation modelling and analysis.

However, despite questions regarding methods, Cano (2005) linked epistemological beliefs to approaches to studying and academic performance in secondary school-aged students. Findings indicated relationships principally between beliefs in quick learning and simple knowledge and a surface approach to studying and poor academic performance. In addition, there was evidence of belief change and female students tended to adopt a deeper approach than males as they progressed through school. Cano's (2005) findings were built upon by Phan (2008) who studied 1197 undergraduate students studying arts and mathematics in the Pacific region. Results reinforced the contention that approaches to learning were a product of epistemological beliefs and that these factors are part of a larger cognitive system that can influence academic achievement.

3.6.5 Initial Development of the EBI

A preliminary series of studies by Schraw et al (1995) and Bendixen *et al* (1998) investigating relationships between moral reasoning and personal epistemology resulted in the initial development of the EBI as a 32 item instrument. This was designed to reduce item-to-factor overlap and to produce the emergence of the omniscient authority which had been elusive for Schommer (1990). This was piloted with 122 educational psychology students in small samples of participants and administered with a reasoning test. The sample participants were psychology graduates and undergraduates in a Midwestern university resulting in 124 and 154 completed questionnaires. The factor analysis with oblique and varimax rotations resulted in a five factor solution with some reasonable (> 0.70) key indicator factor loadings accounting for 60% and 54% of total variation in the samples. Of relevance

here were the findings that education and quick learning predicted more highly developed reasoning skills, whereas the effect of age was not significant.

3.6.6 Comparison of the EBI and EQ

Four predictions were made by Schraw *et al* (2002) about the properties of the Epistemic Beliefs Inventory:

- The EBI would yield a five factor structure with four to five items with item to factor loadings of 0.4 or more.
- The EBI would explain more sample variation than the EQ and at least 50% of total sample variation.
- The EBI would provide better predictive ability than the EQ in a reading comprehension test.
- The EBI would have equal or better reliability than the EQ during the initial test and at retest.

The EBI was administered to 160 undergraduates of whom 104 were female, 54 male and 4% freshmen (1st years), 42% sophomores (2nd years), 43% juniors (3rd years) and 11% seniors (4th years) undertaking an introductory educational psychology class in which ages ranged from 18-46 ($M = 21.4$, $SD = 4.7$). Factor analysis was carried out using principal factor analysis with various rotations. A highly similar solution was reported for all rotations and none of the factors were correlated above 0.30 so the varimax rotation solution in table 3.4 was reported (Schraw *et al* 2002).

Five factors with eigenvalues greater than one explained 60% of total sample variation. The factor were labelled omniscient authority, certain knowledge, quick learning, simple knowledge and innate ability, and each included at least three items with a loading of greater than 0.3 (and none of these loaded onto another factor). This was administered concurrently with the EQ which produced nineteen factors which initially accounted for 72% of sample variation.

The EBI was administered in conjunction with a reading comprehension test, the rationale being beliefs in particular dimensions (certain knowledge, simple knowledge and omniscient authority) might be important in predicting reading ability, and this proved to be significant. Cronbach's alpha for the overall scale was .83 and on retest with the same sample group, the EBI produced five factors accounting for 64% of

Table 3.4: Summary of the EBI structure following exploratory factor analysis (Schraw *et al* 2002). Eigenvalues in brackets and Cronbach's alpha for the subscales are indicated under factor labels.

Item	Factor 1: Omniscient Authority (1.63) $\alpha = .68$	Factor 2: Certain Knowledge (1.63) $\alpha = .62$	Factor 3: Quick Learning (1.47) $\alpha = .58$	Factor 4: Simple Knowledge (1.43) $\alpha = .62$	Factor 5: Innate Ability (1.36) $\alpha = .62$
People shouldn't question authority	.73				
Children should be allowed to question their parent's authority	.66				
When someone tells me what to do, I usually do it	.62				
The moral rules I live by apply to everyone		.72			
What is true today will be true tomorrow		.63			
Parents should teach their children all there is to know about life		.50			
Working on a problem with no quick solution is a waste of time			.71		
If you don't understand something the first time through, going back over it			.53		
If you don't learn something quickly, you won't ever learn it			.49		
Instructors should focus on facts instead of theories				.78	
Too many theories just complicate things				.57	
Most things worth knowing are easy to understand				.44	
How well you do in school depends on how smart you are					.76
Smart people are born that way					.56
Really smart students don't have to work as hard to well in school					.30

sample variation. This was compared with the EQ which produced seventeen factors explaining 39% of the variation and 34% on retest. On this basis Schraw *et al* (2002) concluded the EBI was more effective because of a smaller number of more

homogenous items which loaded highly onto the five observed factors. In discussing limitations, Schraw *et al* (2002) did recognise that there are issues of the paper and pencil self-completion approach with regard to construct validity. Also, it was pointed out that their sample size was low and the analysis employed exploratory as opposed to confirmatory factor analysis, which could be argued as more appropriate after the exploratory phase with data from a new sample (Brown 2006).

3.6.7 Research using the Epistemic Beliefs Inventory

There is limited evidence in the literature of the use EBI in the original form without adaptations or translation. The instrument has been used in a handful of published studies, summarised in table 3.5, and no nurse students have been included in the populations studied. The focus has been on the psychometric properties of the instrument and modifications to improve the scales.

The EBI was used in a study of epistemological beliefs, the need for closure and approaches to learning by DeBacker and Crowson (2006). Key findings indicated:

- Structural equation model (SEM) results indicated less sophisticated epistemological beliefs were strongly associated with a desire for closure, order and surface engagement approaches.
- Mastery goals were negatively associated with naïve epistemological beliefs, but there was a strong correlation between epistemological beliefs and need for closure.

DeBacker and Crowson (2006) postulate this correlation may have obscured the effects of both in the SEM model. However, there are no fit indices reported for the subscales, which raises questions about suitability for SEM.

In a further study, DeBacker *et al* (2008) compared the EQ, EBI (Bendixen *et al* 1998) and Epistemological Beliefs Survey (Wood and Kardash 2002). The data loaded onto the five factors hypothesised by Schraw *et al* (2002), but fit indices indicated poor model fit. However, the 32 item instrument used in this study was not

the published version in Schraw *et al* (2002), which raises questions about the results and the validity of cross-comparisons with other studies.

Ordoñez *et al* (2009) have added further weight to these findings through an extensive psychometric assessment and re-development of the EQ and EBI which resulted in a four-factor inventory, the EQEBI. This was developed through a two-stage process. The EQ and EBI were subject to extensive translation and back-translation procedures to improve construct equivalence and cultural sensitivity.

Table 3.5: Summary of studies using the Epistemic Beliefs Inventory (Schraw *et al* 2002).

Authors	Study	Sample	Procedures	Key findings
DeBacker and Crowson (2006)	Epistemological beliefs, the need for closure and approaches to learning.	259 psychology undergraduate students, 47 freshman, 44 sophomores, 57 third and 50 fourth years from a Midwestern university.	Structural equation modelling.	
DeBacker <i>et al</i> (2008)	Comparison of the EQ, EBI (Bendixen <i>et al</i> 1998) and Epistemological Beliefs Survey (Wood and Kardash 2002)	Two samples of 417 and 378 undergraduate psychology students in a university in the South-eastern United States.	Confirmatory factor analysis.	Poor fit of the data to the model; eleven 32 items had standardized factor loadings of .35 or less. Cronbach's alphas ranged .47 to .68; lowest was for simple knowledge.
Ordoñez <i>et al</i> (2009)	Psychometric assessment and re-development of the EQ and EBI	Initial sample of 215 Colombian psychology, electronics, engineering and languages students. Second sample was 1020 students from the same disciplines as the first study aged 17-40 years; mean age 17.3 years.	Item response theory analysis.	Four-factor model which did not include omniscient authority, in agreement with Schommer's (1990) original model.

The overall findings supported a four-factor model which did not include omniscient authority, in agreement with Schommer's (1990) original model.

3.6.8 The Approaches and Study Skills Inventory for Students

The Approaches and Study Skills Inventory for Students (ASSIST) (Tait *et al* 1998) is a sixty-six item questionnaire using a five-point Likert scale for responses derived from a ninety-nine item pilot. The precursor to ASSIST, the Approaches to Studying Inventory (ASI) (Entwistle & Ramsden 1983), was originally designed as a research instrument and was not intended to be used as widely as it has been (Tait *et al* 1998). The ASI was developed for the purpose of exploring the relationships between the deep and surface learning ideas from Marton and Säljö (1976), and included the concepts of serialist and holist processing from Pask (1976) and student motivation and studying (Entwistle *et al* 1974).

The Revised Approaches to Studying Inventory (RASI) (Tait & Entwistle 1996) was a later development of the ASI. This originally comprised 60 items in four main scales (deep, surface, strategic and apathetic) which produced a four-factor solution explaining 62% of the sample variance when subject to maximum likelihood (ML) factor analysis. The inventory was further shortened to 44 and 38 item versions, but these shared problems of internal consistency found in the 60 item parent version. The development of the ASSIST questionnaire was approached as a 'reconceptualisation' of the ASI and RASI in the light of feedback from several studies in various educational settings and following a confirmatory factor analysis study. The ASSIST was produced with a particular focus on higher education and with the aim of being trialled to a point where substantial revisions were unnecessary and it could be used 'with confidence' (Tait *et al* 1998).

The questionnaire consists of fifty two items (in Section B) containing thirteen subscales and three main scales relating to deep, surface and strategic approaches to learning. The subscale scores can be summed to get composite scores for each of the approaches. Eight items (section C) relate to preferences for teaching single item which asked for a self-rating of performance on a nine-point scale. In a validation

study, a sample of 1231 students, mainly in their first year, studying sixteen disciplines (principally arts, social sciences, science and engineering) in six higher education institutions completed the ASSIST. Again, ML factor analysis was employed and a three-factor solution representing the main subscales explained 60% of variance. A four factor solution representing 44% of variance was also produced, which included an analysis of the preferences for teaching, orientations to learning and preparation for higher education items.

3.6.9 Indications for using the ASSIST for research

Tait *et al* (1998) presented ASSIST with three cautionary provisos; the inventory was designed to be generalist in focus and not discipline specific and it was suggested completing the inventory might raise student awareness or lead to discussion about approaches to learning, thereby precipitating change. Finally, they reported the instrument was not designed to detect changes in teaching practice. It was suggested that students indicating a high score on the deep approach sub-scale were likely to have developed this over time and increases in deep scores were unlikely to be as result of teaching alone. Tait *et al* (1998) cautioned against using the inventory in a pre-/post-test study and suggest that an initial analysis of all subscales was undertaken in order to justify summing them into the main scales for factor analysis. Therefore, ASSIST was not developed as an instrument to measure effectiveness of teaching innovations or routine teaching methods and practice. However, it is often recommended as the test of choice in learning styles research (Peterson *et al* 2007) and the precursor, the ASI, has been used for a variety of application including test-retest studies (Richardson 2004).

3.6.10 Questionnaire Presentation and Administration

The Schraw *et al* (2002) Epistemic Beliefs Inventory (EBI) self-completion questionnaire in the 28 item form was presented to participants with guidance for completion on a single sheet of A4 paper (appendix 3, box 1). From a pragmatic viewpoint, this presentation was considered for ease of completion as opposed to alternatives, such as spreading the questionnaire items across two pages. Permission to use the instrument was obtained from Dr. Gregory Schraw.

The Approaches and Study Skills Inventory for Students (Tait *et al* 1998) was presented on three A4 sheets in the 67 item form. Permission to use the instrument was obtained from Dr. Velda McCune. As outlined in the literature review, in both the ASSIST and EBI each questionnaire item is a statement which could be responded to using a five-point Likert scale on which ranging from disagree (1), disagree somewhat (2), unsure (3) to agree somewhat (4) and agree (5) presented in boxes that could be ticked or circled. Alternative modes of administration were considered, such as internet forms, but these were not sufficiently well developed when the project commenced to be viable in terms of ease of access by students and because of economic considerations. Furthermore, this procedure raised questions about data protection and issues around modification of the survey post-pilot.

Completion time for both questionnaires was estimated at 20 minutes, including administration and a short introduction to the research purpose and guidance for participation and completion. The demographics questionnaire was designed to fit one side of an A4 sheet and to provide information about all participants including age (in ranges), gender, prior occupation and educational qualifications (see appendix one, form 2). The questions were formatted to be answered quickly using a tick box format with a text line available to elaborate on educational qualifications if required. The occupation before course component of the questionnaire was derived from Standard Occupational Classification 2000 (ONS 2000) reduced to a very simplified form to provide broad categories for coding.

A standard introduction was employed to explain the steps involved in the survey and that the questionnaires were being trialled (Grinnell & Unrau 2007) and this is detailed in appendix seven. This enabled minimisation of comments that could cause response bias and was also an opportunity to express thanks for participating and was tailored to the needs of each group. A narrative account of the procedure can be found in appendix one. Students were informed verbally and in the information sheets that completion of the questionnaires and participation in interviews was voluntary and further detail about participation was provided in the information sheet to counter issues regarding coercion.

This is explored in greater depth in the bias and neutrality sections of this chapter, but when the number of completed surveys was compared to the number of students present, it was found that not all students participated. This is demonstrated in the survey results, for example, of 1.09 S1 CFP cohort, 25 students were present on the day of sampling and 22 completed questionnaires were returned (chapter 4, table 4.1). In this study, the questionnaires were not regarded as being overly intrusive or about a particularly sensitive area of experience, so this form of administration with explanation of the purpose of the research was acceptable in order to gain the sample required for the analysis procedures to provide meaningful results.

3.7 Survey Analysis Methods

The responses to the EBI and ASSIST self-completion questionnaire items were entered into SPSS and after data screening, descriptive analyses were followed by exploratory factor analysis (EFA). This multivariate statistical procedure was used to explore data and reduce items into manageable subscales (Ferguson & Cox 1993). Confirmatory factor analysis (CFA) techniques were used to investigate whether the data from the study population would fit the hypothesised five-factor structure of the EBI proposed by Schraw *et al* (2002) and three factor structure of ASSIST (Tait, Entwistle & McCune 1998). Cluster analysis techniques were used to explore different groups of respondents and comparisons of these groups were carried out using both parametric and nonparametric tests because of issues of data normality.

The techniques used for group comparisons included non-parametric ANOVA and multinomial logistic regression, recommended to overcome the categorical nature of the Likert scale data (Field 2005).

3.7.1 Data Screening

This was the first step in the analysis of the survey data and took place as soon as the paper questionnaires were received. The raw data and data matrices were examined for errors, missing values and suitability for the various procedures, an essential initial stage prior to the analysis to avoid meaningless results (Tabachnick & Fidell 2007). Descriptive statistics and bar charts were computed using SPSS to enable 'eyeball' detection of outliers and to inspect plots of the responses to the items for normality, skew and kurtosis (Field 2005). Normality assumptions are not a prime consideration in EFA or multinomial regression (Tabachnick & Fidell 2007), but multivariate normality is a requirement for CFA. Univariate and multivariate normality were evaluated using SPSS by running the 'normtest' SPSS syntax (De Carlo 1997). It has been reported that in personality or psychological research, real life data is rarely normal and may lead to rejection of a reasonable model that is trying to be fitted to a perfect one (Micceri 1989, Raykov 1998). Therefore, in this study, CFA procedures were carried out at item level under the assumption of normality using various techniques to counter problems that then arose (Flora & Curran 2004). It should be noted that in practice, normality issues are rarely addressed in studies using CFA (Finney & Di Stefano 2006).

Missing values were detected using the procedures above, any data entered as '0' were re-entered as a missing value, indicated in the SPSS data table as '.'. This was required to avoid adding an extra response category to the pre-existing Likert scale. Missing data were treated by excluding cases using the listwise option in SPSS, recommended as a safe and conservative action (Tabachnick & Fidell 2007, Field 2005). Other available options included substitution with a mean value, but this can produce significant results that would otherwise be non-significant (Tabachnick & Fidell 2007, Field 2005). Pairwise deletion (i.e. using all available data) was not used because it results in cases being excluded from any calculations involving variables

which they have missing data, but this option can result in the various dimensions of the model being measured using different sample sizes and standard errors. In effect, this means different data sets are used to perform the calculations. Finally, patterns of missingness were studied using SPSS missing value analysis which could indicate potential problems with individual or groups of items.

3.7.2 Descriptive statistic computation

Descriptive statistics, or rather the description of the mathematical model of the observed distribution of the data (Rodgers 2010) were computed using Statistical Package for the Social Sciences (SPSS) 14.0 (2006). This enabled reporting of the characteristics of the sample in terms of demographic variables and instrument scores, to check for violations of assumptions of techniques and to address the descriptive element of the research questions (Pallant 2001). Fundamental information provided by means scores and standard deviations were required to judge the adequacy of the sample in describing attributes of the population (Field 2005).

3.7.3 Factor Analysis Procedures

Rationale for decision making during EFA has been criticised for being briefly reported and subjective (Watson & Thompson 2006, Henson & Roberts 2006). Therefore, procedures from Tabachnick and Fidell (2007) and Field (2005) as outlined in detail in the pilot study (appendix 3) were followed with transparent reporting of the decision-making rationale at each step. An additional step in the analyses was EFA of the polychoric inter-item correlation matrix (Panter *et al* 1997) as a method to reduce measurement error (Holgado-Tello *et al* 2010). Likert-scales do not continuously measured interval data and using ordered categorical data and EFA with Pearson correlations results in a decrease in factor weightings (DiStefano 2002). Therefore they can be regarded as proxies for unobserved variables and polychoric correlations estimate the correlation between raters as if on a continuous scale. Also, this procedure avoids the need for data transformation which is not recommended with Likert-level data if it is non-normal (Nevill & Lane 2007).

3.7.4 Exploratory Factor Analysis Computation

Factor analysis of the data was computed using SPSS 14.0 (2006) and LISREL 8.54 for Windows (Jöreskog & Sörbom 2003) to compute the polychoric correlation matrix.

3.7.5 Confirmatory Factor Analysis Computation

Confirmatory factor analysis of the underlying factor structure of the EBI was carried out using AMOS 7.0.0 (SPSS Inc.) and LISREL 8.54 for Windows (Jöreskog & Sörbom 2003) which was adopted to provide more detailed fit indices.

Fit of the models to the data was assessed using the chi-square index of absolute fit, chi-square/degrees of freedom ratio (χ^2/df) (Tabachnik & Fidell 2007), root mean square error of approximation (RMSEA) and its associated p-value, the standardised root mean square residuals (SRMSR), the comparative fit index (CFI) (Hu & Bentler 1998), goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) (Brown 2006, Kääriäinen *et al* 2011). The factor loadings and standardised residuals were examined to assess the contribution of individual items to the models. Items with low loadings were considered for removal and any with large standardised residuals over 2.58 or -2.58 (Brown 2006) were scrutinised for suitability for inclusion in the analyses. Finally, decisions to include or exclude items in the analysis and thus make minor changes to the model were theoretically driven (Kääriäinen *et al* 2011).

3.7.6 Comparisons of Student Group Differences

Different groups within the sample were compared using parametric or non-parametric tests as indicated by the normality of the data variables under analysis and the population size of the groups. In certain stages of the analyses, both approaches were used to explore any substantive differences in results. The rationale for this approach was it is often apparent in the literature, or when it was arguable as to which approach should be used on the basis of normality or sample size issues which would affect the test, for example, when the instrument scores of students holding degrees or non-vocational qualifications (NVQs) were compared. The procedures used enabled

comparison of different groups of the students on the basis of categorical variables including age, cohort or previous occupational background with scores on the survey instruments. Issues of non-normality in the individual item responses were countered by using total or subscale instrument scores which again, was justified as the approach taken in many of the studies using learning styles instruments in the literature.

American Psychological Association guidelines have been followed in reporting and presenting data in tables where possible (APA 2010). Significance levels are reported with the exact p value in tables and an alpha level of .05 was used for all statistical tests, except where stated in Mann-Whitney testing. Asterisks are used in a selection of tables and figures to emphasise the results. When effect sizes are reported, the measures used are Pearson's correlation coefficient, r , Cohen's f^2 and effect sizes are based on Cohen's (1988) recommendations. Numerical values are reported to two decimal places in tables or rounded up for clarity where appropriate. Percentages are reported to the nearest whole number.

3.7.7 Survey Methods Summary

To summarise, a non-probability convenience sample of students currently enrolled on the bachelor of nursing degree were the population studied. Paper questionnaires were administered with written and verbal guidance about completion of the instruments. The non-return rate and a total response rate was calculated using prior knowledge of cohort size and attendance on the day of sampling.

The data sets were entered into SPSS and examined for missing values, normality and suitability for various statistical procedures. Descriptive and inferential analyses were undertaken to enable profiling of the sample with regard to demographic characteristics and instrument scores and to explore different groups of students within the data.

3.8 Qualitative Data Collection Methods

3.8.1 Semi-structured Interviews

Semi-structured interviews were the data collection method for the grounded theory study. In depth, or intensive, interviewing is a commonly used, powerful and sensitive qualitative research data collection method (Fontana & Frey 1994, Kvale 2006). The interviews were a directed conversation (Lofland & Lofland 1995) in which the aim was to seek to understand the participants' interpretation of experience of the phenomena studied. Semi-structured interviews enabled probing for information whilst investigating sensitive and complex issues (Charmaz 2006a) and provided an opportunity for participants to reflect on their experiences in a manner that would not normally occur in everyday life, consistent with the methodology of grounded theory and the research questions. The semi-structured approach was the method of choice because it offered greater flexibility and allowed greater theoretical sensitivity than a structured interview. This permitted the exploration of student perceptions of complex concepts, which was one of the key drivers for the study.

Elucidation of participant responses was achieved through probing for more information from participants and clarification of their answers, which made it a suitable technique for an inductive approach (May 1991). In structured interviews there is standardisation of the language and thus, the stimulus, whereas semi-structured interviews offered an opportunity to change the words, but not the meaning of the questions, to suit the vocabulary of the participants (Barriball and While 1994). This was important because of the abstract nature of personal epistemology concepts. An interview schedule was prepared following guidance from Charmaz (2006a) to construct a few broad, open-ended questions to encourage the emergence of participants' answers and 'stories' (table 3.6). The etiquette of the interview is an important consideration, and Charmaz (2006a) emphasises the importance of exploring issues normally 'glossed over' in casual conversation and the adoption of an active listening stance, requiring reflection of participant answers through asking open, invitational questions. An audio recording was made for transcription purposes

Table 3.6: Semi-structured interview schedule.

Introductory statement

'Hello, as you know, I'm interested in how you approach studying and regard knowledge. I'd like to ask a few questions and if you don't understand, let me know and I'll put them differently.'

Social influences on studying

Are there influences outside the school that have an impact on your studying?

Omniscient authority/sources of knowledge

Do you rely solely on what the lecturers tell you?

Certain (simple) knowledge

What do you think when evidence or ideas about a subject or procedure changes?

Do you ever think lecturers make subjects overly-complicated?

Quick learning, deep/surface/strategic approach

How do you approach learning about something new?

If you don't get the hang of something, what do you do?

Innate ability

Do you think the way you learn improves, or can improve, with experience?

Transitions in knowledge beliefs

As you look back on the course so far/the last year (CFP/early year two students), can you tell me if your ideas about knowledge or studying have changed?

Would you tell me what occupation you had before you started the course here?

Do you think you would you answer these questions differently if I wasn't one of your lecturers?

during the interviews using a small and unobtrusive digital voice recorder after the verbal consent of the participant was obtained. All participants were informed that names of persons or places would be removed from the transcripts. Interviews were transcribed using software following procedures in Alcock and Iphofen (2007).

It was important to remember the relationship with the student participants because the research interview is contextual and negotiated (Charmaz 2006a). It can be regarded as an encounter in which the interviewer and participant behave as if they have equal status with the aim of constructing a dialogue, yet the reality is, in Kvale's (2006) terms, an asymmetrical power relationship – the goal of the interview is to establish rapport to promote understanding of the other (Fontana & Frey 1994) through a 'warm personal dialogue' about an area of mutual interest (Kvale 2006). However, Kvale's (2006) perception of this is dialogue is that the interest really is on the part of the interviewer and thus, the dialogue is one way and controlled and manipulative. An interviewer wants information but does not necessarily want to reveal their agenda and, furthermore, the information about the personal worlds of the participants can then be presented, or rather interpreted, through the researcher into a publically consumable output.

To counter this potential threat to validity, pilot interviews offered participants an opportunity to influence the interview schedule and direction, and also provided an opportunity to rehearse and reflect upon interview technique and questions. According to Charmaz (2006a), the interview does not just reproduce reality, but it is an account from a particular viewpoint and both parties bring their own viewpoints, experiences and knowledge to it. Staying attuned to these issues, particularly of how my position could be regarded by the participants, meant it was necessary to pay heed to the quality criteria and issues of bias and neutrality. The participants were asked the final question of the schedule as a validity check.

3.9 Qualitative Data Analysis Procedures

3.9.1 Coding Procedures

The foundation of the coding was constant comparative analysis (Glaser & Strauss 1967), a technique that enabled data to be contrasted with both itself and against emerging data. This process was continued for comparison of theoretical and conceptual claims and in terms of quality criteria, paid attention to the requirement for thoroughness. Strauss and Corbin (1998) provide characteristics of a grounded theorist that can be regarded as useful guidelines and reflective prompts:

- Step back and critically analyse situations;
- Recognise the tendency toward bias;
- Think abstractly;
- Sensitivity to words and actions of respondents;
- Absorption and devotion to the work process.

With regards to the second of these guidelines, this is reflected on further in this chapter, but previous knowledge could be a source of bias and also, of theoretical sensitivity. Abstract thought was a requirement of Charmaz's (2000) techniques which required the coding to be gerunds and convey a sense of action and process. The final qualities were a requirement of ethical conduct and the production of the thesis.

3.9.2 Initial Coding

Coding was used to provide a new perspective on the data (Charmaz 2000) and made possible labelling of phenomena to identify concepts as the first step of theory development (Strauss & Corbin 1998). The initial open coding phase enabled examination of interviews line-by-line and incident by incident. As interviewing progressed, the coding process changed and became more incident-by-incident to avoid the production of excessive and descriptive codes (Charmaz 2006a). Constant comparative analysis (Glaser & Strauss 1967) was used to iteratively check and

recheck similarities and differences to compare findings from both individual and different participants with regard to their views, situations, actions and experiences and therefore establish analytic distinctions. The use of 'action codes' (Charmaz 2000) was important here to provide insight into what the participants were doing and thinking.

The pilot study provided some initial sensitising concepts for codes, but it was anticipated new codes would emerge through following the surveys and development of the semi-structured interview schedule, which in turn would enhance theoretical sensitivity.

3.9.3 Memoing

The purpose of memos (Strauss & Corbin 1998) was to provide reminders or notes on sources of information and chart the research journey using raw data as sources. Memos were written early in the analytical process and could contain notes about codes or theoretical developments (figure 2.4). The memo was used as an intermediate step or bridge between coding and theory construction and a route to promote analysis and new views of the data and extant codes. Memoing enabled exploration of ideas and participants stated and unstated actions and assumptions or implicit meanings. The process also linked interpretation with empirical grounding (Charmaz 2000) and was a creative way to explore ideas and different interpretations of the interview codes.

To facilitate memoing, Charmaz's (2006a) questions were used for constant comparison, in her words, 'to open the text up':

- What is this a study of? What is the issue here?
- What does this data suggest? Pronounce?
- From whose point of view? Who are the actors, how do they play and interact?
- What theoretical category does this datum/data indicate? Or, are not mentioned?
How intense is it?

These questions were not applied to every line in the transcripts and interviews, but were held in mind to assist the re-examination of ordinary issues the students raised.

Structure of knowledge and learning – learning here was expressed using language which conveyed the sense of studying as a form of collecting authoritative sources – books, journal papers, reading lists, electronic resources from Blackboard from sources of authority – teaching staff.

Personal constructions of knowledge could be seen to be based on common sense or built upon the most accessible or abundant information. This was probably the underlying driver for collecting and gathering information, to enable the house of knowledge to be built. Information that was the cause of liminality might be avoided because it intuitively felt wrong, however, this can be a way to avoid the challenge and could lead to studying wrong information.

Figure 3.2: Example of early memo about the structure of knowledge and learning.

3.9.4 Focussed and Theoretical Coding

Focussed coding was used to form the initial coding into categories to conceptualise the data. It was more directed and selective than the line-by-line initial coding process and was used to capture main themes in statements from the interviews (Charmaz 2006a). Theoretical coding enabled the establishment of relationships between codes as a step in developing substantive theory and was developed using diagrams as a further means for presenting and understanding the theory.

3.10 Data Analyses and Integration

Guidance for integrating data in mixed methods is an under-theorised and under-developed area (Bazeley 2009), but there are recognised integration strategies and points where the process can occur. The datasets were treated separately with techniques usually associated with that data type (Sandelowski 2000, Onwuegbuzie and Teddlie 2003), conforming to the recommendations in Morse *et al* (2006). The process of mixing, or integration, occurred most transparently and predictably at the interpretation phase after the separate analyses. However, the analyses of each data set were not entirely separated; issues arising from the results of the quantitative analyses were used to inform the qualitative grounded theory data collection and analysis and vice versa. This was achieved through the construction of a semi-structured interview schedule which contained questions and probes from the quantitative analyses and during the interviews themselves as foreshadowed questions (Rodwell 1998). This form of integration was adopted as it was intended that the qualitative component would be sequential and complementary to the survey and was not to be regarded as a separate study in its own right because of the influence of the survey. Furthermore, the grounded theory raised questions that prompted a return to the survey data to re-examine particular issues with a different focus.

Details of the practicalities of how data integration is actually done are sparse (Greene 2007), so techniques adapted from Mason (1994) were used to address issues about how to 'glue together' data and findings after the separate analyses. This was not a straightforward task, and required careful consideration and adoption of a philosophical position on just what phenomena the different datasets represented as this was not intended to be a validity check. The first step was following up similar themes in the different data sets as a way to link the data. This was then followed up by asking questions of the data, which Mason (1994) refers to as 'problematizing'. Through developments of propositions which were statements about a conceptual issue, questions could be generated, for example, students who adopt a surface approach to their studies will have a greater propensity to believe in the simplicity of knowledge. A question oriented around that proposition could then be constructed, such as, do students who express a preference for a surface approach to study state

particular beliefs about knowledge? These questions could then be tested against the two datasets to enhance understanding of the themes and processes within them. Propositions, or statements about the concepts, that emerged from the study were seen as more appropriate than hypotheses because of the exploratory nature of the research questions (Sarantakos 2005). Hypotheses could be derived from propositions for empirical testing in future research.

3.11 Rigour and Robustness

3.11.1 Validity and Reliability

The quantitative methods used in this study had explicitly defined measures of validity and reliability explained in the methods and analysis section, but there were specific considerations with regard to using the EBI because there was no evidence of it having been used before in a nurse education context. The scale, or content, reliability (assessed using Cronbach's alpha coefficient) was explored in the pilot study. Face validity of the EBI was considered an issue because certain items could appear unusual on the first reading, for example item four, 'People should always obey the law', or item nineteen, 'Children should be allowed to question their parents' authority' and later analyses reinforced this. However as Kline (2000) points out, there is no logical relationship between face and true validity and face-valid tests are open to guessing by participants. Assessment of items was carried out during the pilot study to determine whether items could be removed for the main study. Construct validity was determined using both exploratory and confirmatory factor analyses.

3.11.2 Rigour and Trustworthiness

Constructivist grounded theory is an interpretivist research method and was intended to be used here to explore subjective and contextually derived interview data. Furthermore, the abstract concepts of personal epistemology are difficult to express or articulate, let alone consider, and so were inferred from the experiences and events

presented in the student interviews. Grounded theory is not intended to give an accurate portrayal of the world, and constructing the theory is not a neutral act but one reflecting the conditions in which the research is undertaken. Therefore, alternative measures of rigour and robustness to enhance credibility, or trustworthiness, were used than those for quantitative methods (Tobin & Begley 2004). These can be considered as criteria analogous to validity and reliability, but this stance has been denounced by purists as derived from quantitative or experimental research standards based on positivist philosophy (Yonge & Stewin 1988).

Johnson (1999) warns against taking up any 'mystical' pseudoscientific view of qualitative research, balancing this against the adoption of a 'positivistic' version of qualitative research. This is exemplified by reference to Strauss and Corbin's (1998) 'rigid' procedures and techniques, which is echoed by Rolfe (2006) who suggests their grounded theory is reconstructed post-positivism. It should be noted that Strauss and Corbin (1998) and Charmaz (2000) explicitly reinforce the point that they do not imply 'rigid adherence' to their procedures, but advocate flexible adoption dependent on circumstance. However, Sandelowski and Barosso (2002) have observed there is a lack of consensus over criteria for rigour and trustworthiness because of the diversity of worldviews of qualitative researchers, and they question the presumption that there should be agreement.

3.11.3 Primary and Secondary Criteria for Rigour and Robustness

In order to provide some clarity for determining rigour and robustness in this study, primary and secondary validity criteria for qualitative research were adopted (Whittemore *et al* 2001, Tobin & Begley 2004). These were derived from, and integrate, Lincoln and Guba's (1985) credibility, transferability, dependability and confirmability with criteria from other sources (figure 3.3). Central to this synthesis is the concept of trustworthiness, which arises from the research reader making judgements about the truthfulness of a study and makes it 'worth paying attention to' (Lincoln & Guba 1985). This relies on the researcher making clear their procedures for audit, although this implies knowledge of this process on the part of the reader. The notion of trustworthiness could be perceived as being broadly the same as the

positivist notions of validity and reliability and the need to provide proof that these have been achieved. Arguably, the distinctions between the two paradigms and how to judge the quality of research are not clear cut (Morse *et al* 2002, Rolfe 2006). However, consideration of some form of quality criteria was of importance because of the potential threats to trustworthiness raised by the mixed methods design and the need to ensure rigour in the interpretive research process.

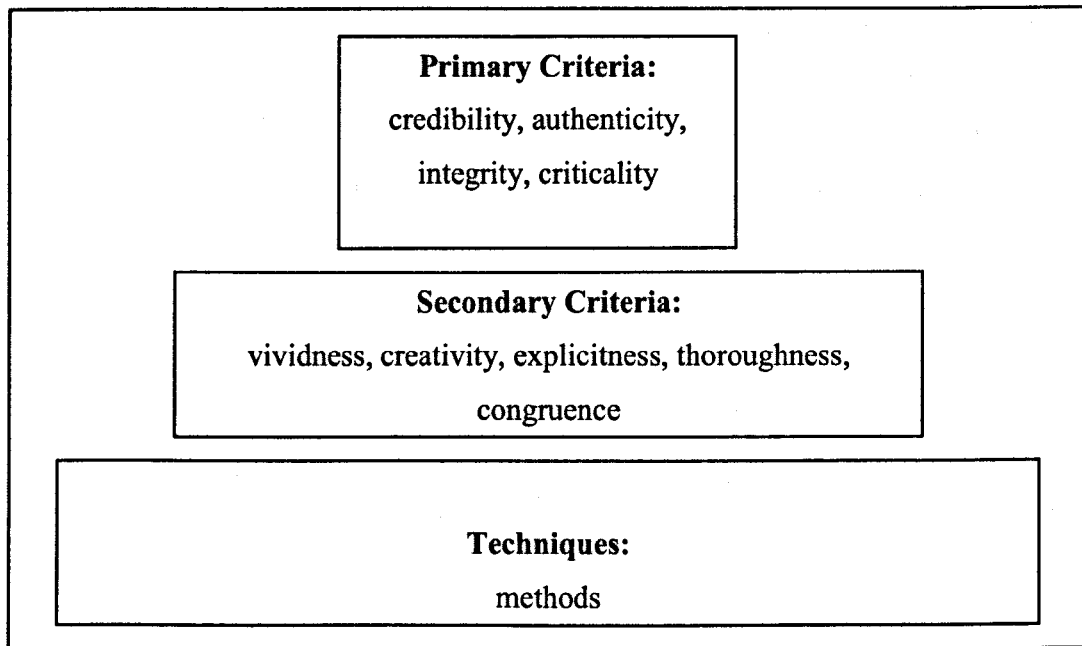


Figure 3.3: Diagrammatic representation of primary and secondary validity criteria for qualitative research (Whittemore *et al* 2001).

Credibility and trustworthiness were the overarching primary criteria (Lincoln & Guba 1985) along with authenticity (Guba & Lincoln 1989), which is closely related to credibility. Close attention to these primary validity criteria could begin to address threats to this aspect of the study (table 3.7). Also, the research process was systematic and auditable by adhering to established grounded theory procedures and showed evidence of critical appraisal. This also linked to creativity, which refers to the way in which imagination was demonstrated in the use of methods.

Despite Johnson's (1999) and Rolfe's (2006) criticisms, the data collection and analysis procedures described by Strauss and Corbin (1998) and Charmaz (2000) were adhered to in order to provide rigour or enhance construct validity, the foundations of which were the iterations of constant comparisons and questioning of the data, or recursive checking of interpretations, during the coding and analysis process and humble presentation of findings.

The base of the diagram representing these criteria is founded on the use of appropriate techniques with underpinning rationale to provide linkages to the methodology and philosophical assumptions. The techniques used in qualitative research may be adapted (Whittemore *et al* 2001); in this study, established grounded theory techniques were applied and discussed as in the qualitative methods section. In the next section of this chapter, pilot studies are described which allowed for testing and refinement of the methods and instrumentation used in the study.

Table 3.7: Features of primary and secondary validity criteria for qualitative research and implementation in this study.

	Primary Criteria
Credibility	Concerned with the relativistic nature of the truth claims of the interpretivist paradigm. Established through deciding whether the study findings accurately represented the experiences of the participants and their context in a way that was convincing.
Trustworthiness	Of concern because the researcher is the data collection instrument in a grounded theory study. Findings were intended to accurately reflect the experiences of the participants in a believable way.
Authenticity	Required portrayal of those same participant experiences and context, whilst paying attention to the voices of participants and accounting for their perspectives, possibly warts and all, of the voices of others through recognition of subtle differences in voices of participants to expose conflicting or multiple realities (Sandelowski 1986).
Criticality and integrity	Addressed through reflexivity, open enquiry and critical appraisal of the processes and findings. This was achieved during the grounded theory analysis through considering biases, negative cases and alternative hypotheses, which was clearly congruent with the exploratory nature of the quantitative approach and integrating results of the factor analysis into the grounded theory process.
	Secondary Criteria
Creativity	Demonstrated through the use of methods and data collection and analysis. Here, the integration and complementarity of the data and findings was one route to demonstrate this.
Thoroughness	Refers to data quality and was an appropriate secondary criterion to inform consideration of issues such as sampling adequacy and data saturation, or theoretical sampling, in order to convincingly answer the research questions.
Congruence	Evident not only through the links between questions, philosophical stance, methodology and methods, but through connections between analyses, findings and other studies. Legitimised if it is the purpose to present a new perspective on the topic under consideration (Rolfé 2006) and methods are appropriate to the context of the study, thus avoiding accusations of 'method slurring' (Baker <i>et al</i> 1992).
Sensitivity	Attention to ethical design and the purpose of the study in producing knowledge for the community represented by the participants, rather than for the knowledge community, was a requirement to meet the criterion of sensitivity.

3.12 Pilot Studies

3.12.1 Epistemic Beliefs Inventory Pilot Study

The questionnaire pilot was a feasibility study undertaken between January 2006 and April 2007 to explore the validity of the EBI (Schraw *et al* 2002) with the purpose of revealing unforeseen problems and developing new insights into the instrument (Peat *et al* 2002). The EBI had not been used with student nurses in the UK before and so could be regarded as unknown, whereas the ASSIST (Tait *et al* 1998) and derivatives were well documented in higher education literature although there has been limited use in nurse education studies. The time frame included administration of the questionnaires and data processing, analysis and interpretation which required learning and practicing techniques.

The main thrust was to establish the factorial validity of the EBI questionnaire to determine whether it was measuring the underlying constructs that it was intended to and to establish the reliability of the instrument with this new population. This approach also enabled scrutiny of items and their suitability for use with student nurses. The rationale for decision making during the analysis is clearly presented with accompanying data and statistical tables in appendix six to ensure adequate reporting of the procedures used (Watson & Thompson 2006).

A sample of 286 respondents completed the questionnaire. The key findings were a five-factor structure could be demonstrated in the dataset that was in agreement with previous reports in the literature (Schraw *et al* 2002). The CFA results should be treated with a degree of caution because of the non-normality of the data, but on the basis of the loadings from the EFA and the CFA five items were removed from the EBI to improve instrument reliability. The procedure for removal of items is explained in detail in appendix six. The format was redesigned on the basis of these findings in conjunction with the missing data analysis; the revised EBI (rEBI) was then used in the main study.

3.12.2 Grounded Theory Pilot Study

A pilot study was undertaken between June and August 2006 with a similar aim to questionnaire pilot, but in the context of the grounded theory approach. It served two purposes, the first of which was to enhance theoretical sensitivity to inform the production of a semi-structured interview schedule. Second, it was an opportunity to practice and refine research interview techniques and grounded theory methods including constant comparison, coding, memoing and category formation. To this end, eight pilot interviews took place with signed consent from the participants. These were unstructured, but the first question asked how the participant thought the course was going. As the interviews progressed, categories or conceptual codes emerged which included:

- Transitions in learning
- Silence
- Innate ability
- Relationships with others/family
- Gendered ways of knowing
- Relationships with knowledge
- Sources of knowledge

The interviews demonstrated how students were prepared to talk about various aspects of their learning experiences, but extracting relevant data that would contribute to answering the questions need careful question construction and .

3.12.3 Reflexive Account

Through listening to the recordings of the pilot interviews and producing and reading transcripts, areas for improvement were noted. These included constructing clear questions where possible and providing time for the participants to consider them and respond. Missed participant cues and questions where ambiguities in the use of language were noted for improvement upon. This was not straightforward because of

the nature of the concepts of interest and it was important not to be suggestive or to provide cues worded in the language used in the literature.

The pilot interviews highlighted a need to be attentive in the main study to cues and potential leads to follow using probe questions to explore issues further. Also, it emphasised the need to maintain records and notes to provide information about the context of the interview.

3.13 Ethical Considerations

3.13.1 Researcher Bias and Neutrality

Working with students who could be regarded as a captive population raised issues related to researcher bias and neutrality that required careful consideration and reflection upon (Schutt 2006). Primarily this was because of the researcher as practitioner role, with specific regard to how that role could influence the study and bias findings. Defining bias was in itself problematic, but Hammersley and Gomm (1997) define it in general terms as 'systematic error'. More specifically it can be a conscious or unconscious move on the part of the researcher to interpret or analyse data in a manner that is driven by commitments rather than in an objective or 'truthful' way.

From the literature review, it was apparent there were clearly defined factor structures for the EBI and ASSIST and models of personal epistemology derived in previous studies which could subjectively drive the QUAN analyses in this study. Therefore, during quantitative data collection and analysis, researcher bias was minimised by using statistical data reduction methods with objective techniques to inform and provide rigor to the decision making process which had to be as data driven and evidence-based as possible. By approaching the quantitative component of this study from a positivist paradigm, there were assumptions made regarding objectivity, bias and neutrality. However, the factor analysis provided subtle challenges to this viewpoint because some decisions, for example the number of factors to extract, could

become subjective, although this was countered by the CFA which is much more rigid procedurally. Transparent and proportionate reporting of the procedures and results and using the most rigorous techniques currently available were employed as a means to address potential criticism of any subjectivity.

The qualitative, inductive arm of the study was interpretivist in nature and my role as a lecturer or teacher could not be divorced from the context I was working in. As a qualitative researcher it was essential to acknowledge and understand how I was part of the research process and how this would affect the analysis and results. Indeed, involvement as both a researcher and practitioner is a feature of Strauss and Corbin's (1998) and Charmaz's (2006a) approach to grounded theory. The researcher's experience of the field of study can be viewed as an asset, although the impact on the world being studied and the data collection and analysis needs to be carefully considered and reflected upon (Cutcliffe 2000). As a result, previous experience is not bracketed out and being a researcher in the researched is less problematic, but many aspects of the study were driven from my perspective and thus necessarily open to bias. The grounded theory approach and methods adopted to reduce bias have been discussed previously in this chapter.

Unstructured pilot interviews were undertaken as a means to practice and refine interview techniques and to provide data to assist construction of questions for the semi-structured interviews in conjunction with the survey results. Good quality interview data required rapport with participants and this in turn required an approach that respected their perspectives, even if they were questionable or different to my own. Charmaz (2006a) asserts this respect should pervade the course of the research process and is needed so the researcher can make a concerted effort to learn about participant views and actions and understand them from their perspectives. These views of the world can then be interpreted rather than reproduced. The interview as a data collection method posed challenges because of the need to engage with student participants and attempt to elucidate their ideas and conceptions about abstract attitudes and beliefs. This had to be balanced against a need to avoid priming them with very focussed and suggestive or leading questions that would give the answers I wanted, as opposed to an authentic representation of their realities. Also, the

relationship I had with students was one that I valued, and careful consideration was needed to avoid abuse of that relationship. This is explored further below.

3.13.2 A Framework for Reflection on Ethical Practice

Criteria offered by Wendler and Grady (2008) were used as an aid for reflection to clarify these issues further (table 3.8). They proposed that potential participants need to understand what a study involves in order to decide whether or not to participate. However, according to Wendler and Grady (2008), if such a decision is to be made, individuals need to understand more than just how the study will affect them. They propose participants should have opportunity to understand three aspects of participation:

- Research contribution;
- Research relationship;
- Research impact.

These three areas can be applied to educational research with student nurses. Understanding the research contribution, research relationship and research impact can help student nurses to decide whether or not to take part in a study, thereby enhancing the process of informed consent (Bradbury-Jones & Alcock 2010). Some of the following material including table 3.8 has been adapted from that paper.

3.13.3 Research Contribution

Research contribution is concerned with how the research study will contribute to a body of knowledge. Thus, potential participants were provided with sufficient information to inform them that they would be contributing to a project designed to gather knowledge that may benefit others in the future (Wendler & Grady 2008). Also, information was provided for participants to be able to ask questions of the researcher and supervisor. The information letter was designed to do this as clearly and succinctly as possible (appendix two).

Table 3.8: A framework for ethical research practice.

A	Research Contribution	B	Research Relationship	C	Research Impact
1	Do participants understand the purpose of the study?	1	Do participants understand the relationship that they are entering into?	1	Will participants face risks that they would not have faced otherwise?
2	Do participants know that they are contributing to a project to gather generalisable knowledge to help others in the future?	2	Are participants aware of how the relationship with the researcher/s will differ from other relationships that they may have with them (nurse, educator, manager)?	2	Do participants understand the potential risks of taking part in the research?
3	How much information do participants need in order to understand the nature of the research?	3	What are the potential role conflicts?	3	What benefits may participants gain from taking part in the research?
4	Are participants likely to be confused by the information provided to them?	4	What strategies are required to manage potential role conflict?	4	How can any emotional effects on participants be managed?
5	Are participants able to understand the language used in communication to them?	5	What potential is there for abuse of researcher power?	5	What ongoing mechanisms are required to support/help participants if necessary?
6	What mechanisms are required to ensure that potential participants can ask questions about the research?	6	What mechanisms are in place to minimise the negative influence of researcher power?	6	Have all potential participants been provided with an equal opportunity to take part in the research?
7	What external pressures might impact on the fair treatment of participants?	7	How easy will it be for potential participants to decline to take part in the study?		
		8	What mechanisms are in place to facilitate participants' withdrawal from the study if they wish?		

To counter issues of bias with regard to student response a standard introduction to the survey was used which emphasised that it was part of a research project and was not a test (appendix seven). Assurances of confidentiality were given with an expression of appreciation after the questionnaires were returned and there was an opportunity to answer questions about the survey. The standard introduction was used to minimise comments that could bias student responses (Schutt 2006). This was also the purpose of the semi-structured interview schedule.

Understanding the research contribution was important for potential student participants because there may be no immediate benefits for the individual in the generation of knowledge through research. However, people often consent to participation for altruistic reasons rather than for their own gain (Eide & Kahn 2008). This was evident in experiences of recruiting students for research whereby verbal responses were typically along the lines of 'I'll do it if it helps'. Presumably this reflected their acquiescence on the basis of 'helping' to generate knowledge to benefit nursing, rather than benefiting themselves as individuals.

3.13.4 The Research Relationship

It was important that potential participants understood the likely nature of the relationship between them and the researcher. An obvious consideration was to guard against the potential misuse of the relatively powerful researcher position. This is important because allowing a researcher into one's life for study may in itself imply a loss of power. In qualitative research the risk of exploitation may become especially acute because of the close psychological distance between researcher and participant (Polit & Beck 2004). By contrast, it is arguable that participants in qualitative studies actually have more power because of the constant re-negotiation between researcher and researched (Haigh *et al* 2005). Ramos (1989) cautioned that the listening ear of the researcher may stimulate disclosure of intimate details which in itself can be construed as manipulation. Overall though, irrespective of the type of research, participants enter into a special relationship with researchers and it was crucial that this was not exploited, either overtly or subtly.

Additionally, potential participants were advised not to hesitate to ask if they did not understand the information and explanations given (WORD 2008). However, according to Neville and Haigh (2003) the world of the researcher is alien to most of the population and is characterised by strange environments and peculiar language. It is for this reason that finding the voice to question may be difficult and as Neville and Haigh (2003) argue, it may be naïve to assume that a 'no thank you' is within the scope of some potential participants.

Given that students on nursing programmes do have a 'choice' to participate it would be tempting to consider their vulnerability to coercion minimised. Holzhausser *et al* (2008) argue with Watson's (2006) position by saying that this reflects a viewpoint that protection of the patient is paramount, whereas the protection of staff is not so important. The central argument is that nurses and student nurses deserve the same degree of protection as their patients. Specifically in relation to students, Clark and McCann (2005) state that abuse of researcher power, coercion, lack of confidentiality and absence of meaningful informed consent can be problematic. Furthermore, they argue that students may experience overt or subtle pressure from lecturers to participate in research, particularly if it is presented as a learning opportunity (Clark & McCann 2005). In common with other criteria, understanding the research relationship was a grey area. It could be argued that to some extent exploitation of the research participant is inevitable and people, opportunities and situations can all be exploited to derive rich data.

3.13.5 The Research Impact

All research involves some risks or potential harm (Williamson 2007) although in many cases these are minimal (Polit & Beck 2004). Thus, potential participants should understand what impact the research will have on them and the potential risks they face that they would not otherwise (ICN 2003, SRA 2003, RCN 2007, Wendler & Grady 2008). Moreover, protection of participants from such harm arising as a consequence of their participation in research was a priority (Firby 1995, SRA 2003, IES 2004).

While the potential for physical harm may be obvious, the psychological effects, such as upsetting people, may not be as obvious (Johnson & Long 2006). There is an acknowledgement that these psychological effects of research need careful consideration (Munhall 1991, Robley 1995, Clark & McCann 2005, Williamson 2007). In relation to emotional upset, Long (2007b) acknowledged that emotional distress is a possible risk for participants in research studies and some degree of upset may be acceptable. It is argued that if progress is to be made through research in health and social care then a degree of minor (or even more serious) emotional distress may be both allowable and necessary (Long 2007b).

As well as harm, however, there may be benefits to taking part in research of which potential participants should be aware. For example, talking has therapeutic benefits and people find relief in getting things off their chests (Munhall 1991). Similarly, attention is viewed as a positive experience and being important enough to be studied can be viewed positively (Munhall 1991). Benefits of students taking part in educational research could be argued on the grounds that students maintain higher levels of attention, retain greater information, and enjoy learning when they are more active in the learning process, such as participating in research, rather than in passive roles, such as in lectures (Dalziel 1996).

Advancement of knowledge and pursuit of information are not sufficient justification for overriding other social and cultural values (SRA 2003). Issues of research contribution and research impact needed to be understood by potential participants, and carefully managed. Balancing risks and harms contains several grey areas and, unfortunately, such balancing relies upon an unscientific process in which risks and potential benefits cannot usually actually be measured (Long 2007a). Human judgement is required, thus there is always an element of uncertainty about the resulting decision (Johnson & Long 2006, Long 2007a). Ironically, potential participants might have perceived harm in not taking part in the research. Subjects were assured that their refusal or withdrawal from participation would not lead to any penalty, but the crucial issue was their perception of what might happen (Clark & McCann 2005).

To conclude, this framework facilitated reflection on the ethical questions raised by study working with student nurse participants. In terms of the nature and extent of harm in educational research, this could involve minor inconvenience and although this could be minimised, complete avoidance was probably impossible (Johnson & Long 2006). Johnson (2003) suggests that researchers should ask ‘What *real* harm can be done?’ and being a good researcher means: not doing (too much) harm; doing (some) good.

3.13.6 Ethical Procedures

Procedures for maintaining anonymity and data retention were briefly explained verbally as outlined earlier during administration of the questionnaires and presented in greater detail in the participant information sheet. Student participants who volunteered for the interview phase of the study also signed a joint researcher and participant consent form. This requested participant contact details which were then entered into a spreadsheet and a single copy stored on a secure password protected university computer network drive as per ethics committee advice. This was deleted at the end of the study. Completed questionnaires were checked for anonymity and stored in a locked cabinet. Interview recordings were converted to MP3 sound files and stored in a folder on a secure university computer network drive. To ensure anonymity was maintained, names and places were not entered at the transcription stage and underline characters ‘_____’ were used to indicate identify names in the final transcript and are used in supporting excerpts in the text of chapter five.

3.14 Chapter Summary

This chapter has laid out the methodology and methods for this study and the rationale for the methods used to investigate the research questions. A pragmatic methodological approach justified exploration of the research questions from different paradigmatic viewpoints. The mixed methods QUAN →qual research design using survey and constructivist grounded theory methods enabled the approach to be put into practice. The purpose of the mixed methods approach was to complementarity, to enhance the snapshot-view provided by the survey instruments with contextual, rich descriptive analysis. Pilot studies enabled the epistemic beliefs inventory to be tested for suitability for use with student nurses and promoted the development of theoretical sensitivity in relation to the grounded theory approach. Semi-structured interviews were a route to exploring issues of personal epistemology and approaches to studying from a student-oriented perspective.

Chapter Four

Survey Results and Discussion

4.1 Introduction

The results from the QUAN survey component of this mixed methods study are presented in this chapter. After an analysis of missing data, the demographic characteristics of the participants are described to provide a profile of the students in the survey sample's age, chronological position on the course, and their previous educational and occupational backgrounds in broad terms.

The student sample profile is followed by analyses of the individual surveys using appropriate inferential statistical methods. Exploratory and confirmatory factor analyses indicate patterns in the data and establish factorial and discriminant validity of the instruments. These factor analysis procedures provide information about the data in terms of items and factor structures within instruments which are used to validate and construct subscale scores. By contrast, cluster analysis and multinomial regression techniques enable groups of individuals rather than groups of question items within the data to be defined and explored further.

Comparisons of groups of participants with different characteristics within the datasets based on the clusters are made using both parametric and non-parametric techniques as appropriate to explore where areas of significant difference existed. The results of the survey are summarised at the end of this chapter and will be discussed in greater depth and integrated with the grounded theory in a synthesis of findings in chapter five. Supplementary tables and figures are included in appendix eight to provide detail of the results of procedures to meet reporting requirements (Watson & Thompson 2006) and to avoid excessive data presentation in this chapter.

4.2 Data Screening and Missing Data Analysis

The questionnaire responses were initially coded into the SPSS data editor as separate files to facilitate error checking and were then merged into one dataset containing all of the raw questionnaire data. Data were screened as described in the methods section 2.6.1 and the missing data summaries for the revised EBI (rEBI) and ASSIST are presented in appendix 8, tables 1 and 2.

4.2.1 rEBI Missing Data

The data missing from the rEBI survey appeared to be missing at random and was negligible, with eight items having one missing entry and item six having two missing entries, representing 0.5% of the total dataset. This level of missing data was under the 5% threshold recommended as acceptable by Tabachnick and Fidell (2007), so no further action was taken to modify the dataset prior to the analyses.

4.2.2 Assist Missing Data

The main ASSIST scale of 52 items concerned with studying (section B) had 582 missing data items missing out of a total of 10244 items which represented 6% missing data in this dataset. Overall, there were 668 missing responses out of a total of 13199 responses, representing 5% of the total dataset including sections A, what is learning and C, preferences for teaching and the final question concerned with student progress. The missing value analysis indicated a pattern of between eighteen and twenty missing responses per item for items 14 to 42 and ten missing responses per item for the items a-f in the 'What is learning' section at the start of the questionnaire. This was significant and after reviewing the missing data analysis it appeared the missing responses could be explained by the presentation of the ASSIST items in the booklet. Items 14 - 44 were on one page of the questionnaire, so it appeared this page had been completely overlooked by some participants. Other missing data appeared to be missing randomly with no apparent pattern for the missingness. In order to get the fullest information from the dataset, ASSIST analyses were carried out using the original data and with missing data estimated using EM (expectation maximisation) estimation to reduce bias in factor analysis (Bernaards & Sijstma 2000). Skew and

kurtosis were calculated using Normtest (DeCarlo 1997) at item level for the EBI and subscale score level for both EBI and ASSIST (Section 4.12, table 4.8).

4.3 Sample Characteristics

In total, 197 completed questionnaires were returned, which represented a 63% response rate when the number of individuals ($N = 314$) available from all of the cohorts approached were taken into account. Data were collected between 24.3.08 and 7.4.09. Response rates (summarised in table 4.1 and figure 4.1) demonstrate the potential number of students in each cohort. The number of students in year one, CFP, was 125 (cohorts 2/07 to 1/09) and 72 students were in branch, years two and three (adult and child, 2/05 to 1/08). Students in 1.08 (1.08 CFP) were sampled at the end of year one, site one, and the start of year two (1.08 AB), site two.

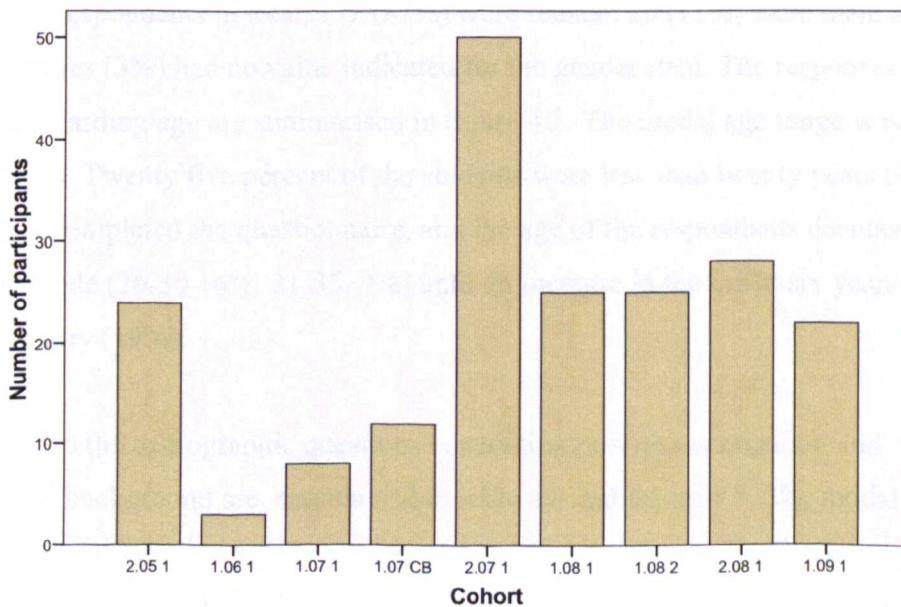


Figure 4.1: Summary of sample responses by cohort.

Key: 1 or 2 after the cohort identifier indicates the site number.

Table 4.1: Response rates by cohort indicating total number of individuals per cohort

Cohort	Year of study	Sample total	Percent	Cohort total
2.05 AB 1	3	24	12.2	31
1.06 AB 1	3	3	1.5	28
1.07 AB 1	3	8	4.1	42
1.07 CB 1	3	12	6.1	12
2.07 CFP1	1	50	25.4	56
1.08 AB 2	2	25	12.7	30
1.08 CFP1	1	25	12.7	33
2.08 CFP 1	1	28	14.2	58
1.09 CFP 1	1	22	11.2	24
Total		197	100.0	314

Key: AB – adult branch, CB – child branch.

4.3.1 Participant Demographic Characteristics

Of the 197 respondents in total, 172 (87%) were female, 20 (11%) were male and five questionnaires (3%) had no value indicated for the gender item. The responses to the question regarding age are summarised in figure 4.2. The modal age range was 21-35 years (28%). Twenty five percent of the students were less than twenty years old when they completed the questionnaire, and the age of the respondents decreased from the mode (26-30 16%, 31-35, 9%) until an increase in the thirty-six years or older category (19%).

Responses to the demographic questions concerning previous occupation and educational background are summarised in table 4.2 and figure 4.3. The modal and predominant previous occupation before starting the course was health care support or residential care work (47%) followed by no prior occupation, fulltime parenting or student roles (25%). Seventeen percent of the participants indicated they were previously employed in manual, plant or machine or building work, clerical, secretarial or sales occupations. Six percent of students indicated the fourth occupational category, manager or administrator, professional occupation, engineer or teacher, as their previous occupation.

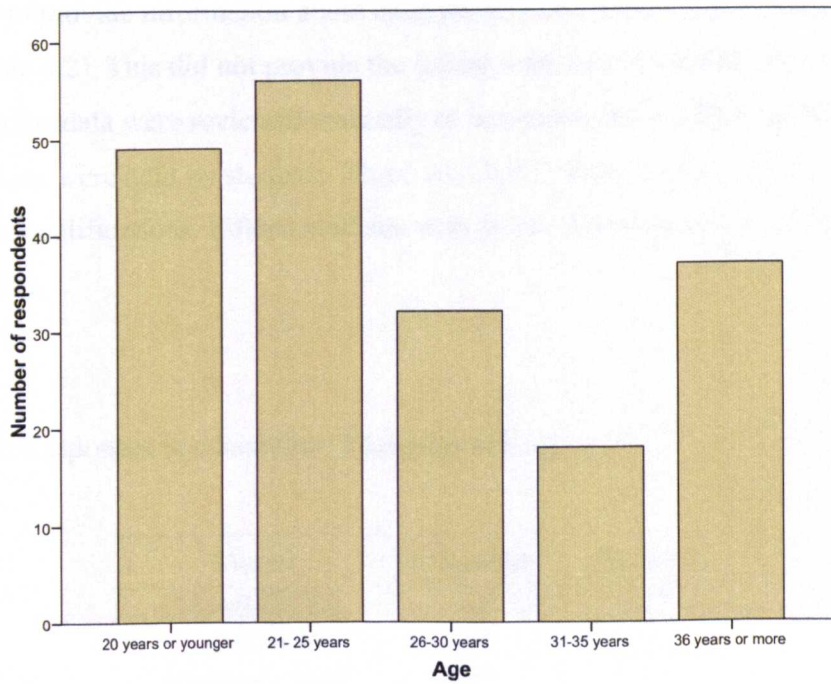


Figure 4.2: Responses to the demographic questionnaire item regarding age.

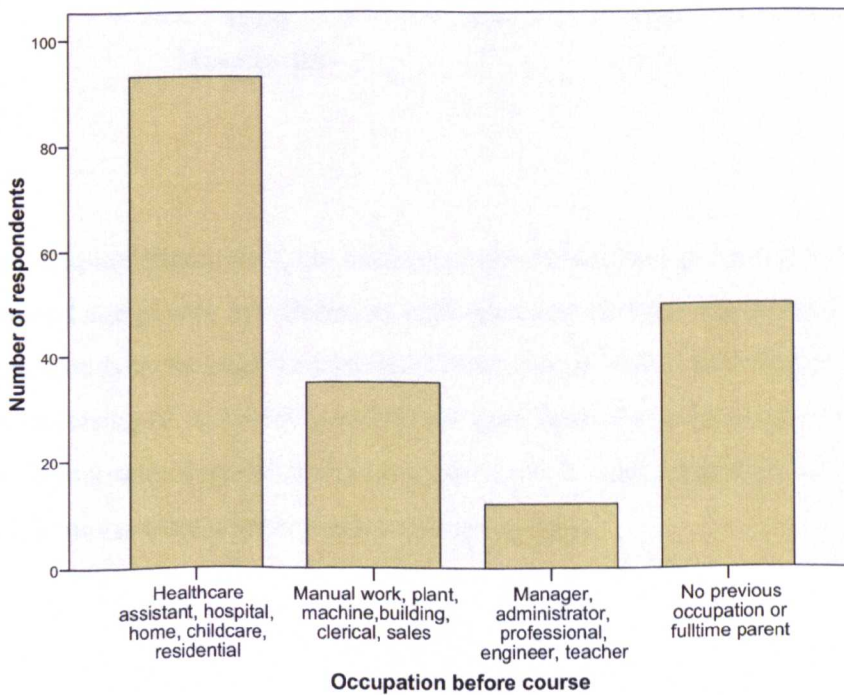


Figure 4.3: Responses to demographic questionnaire item occupation prior to commencing course.

The data from the educational background item were analysed by recoding the responses to provide information about each participants' highest recorded academic award (table 4.2). This did not provide the fullest information possible from the dataset, so the data were reviewed manually to determine what additional relevant qualifications were held by students. Three who held a BSc and four, a BA, also had NVQ level qualifications. Fifteen students with an NVQ had also held an access qualification.

Table 4.2: Responses to educational background item.

Award	Frequency	Percent
O level/GCSE	12	6
A/AS level	48	25
Access Course	45	24
NVQ Level 3	49	26
BTEC	20	11
BA degree	8	4
BSc degree	7	4
BEd degree	1	0.5
Total	190	100
Missing data	7	3.5

In the panel display (figure 4.4), the variables educational background, previous occupation and age groups are plotted as histograms to facilitate visualisation and demonstrate trends in the multivariate data (Becker *et al* 1996). The display clearly shows the clustering of A/AS level and BTEC qualifications in the younger age students and post-school qualifications used for entry by older students. Interestingly, NVQ qualifications were common across all age groups.

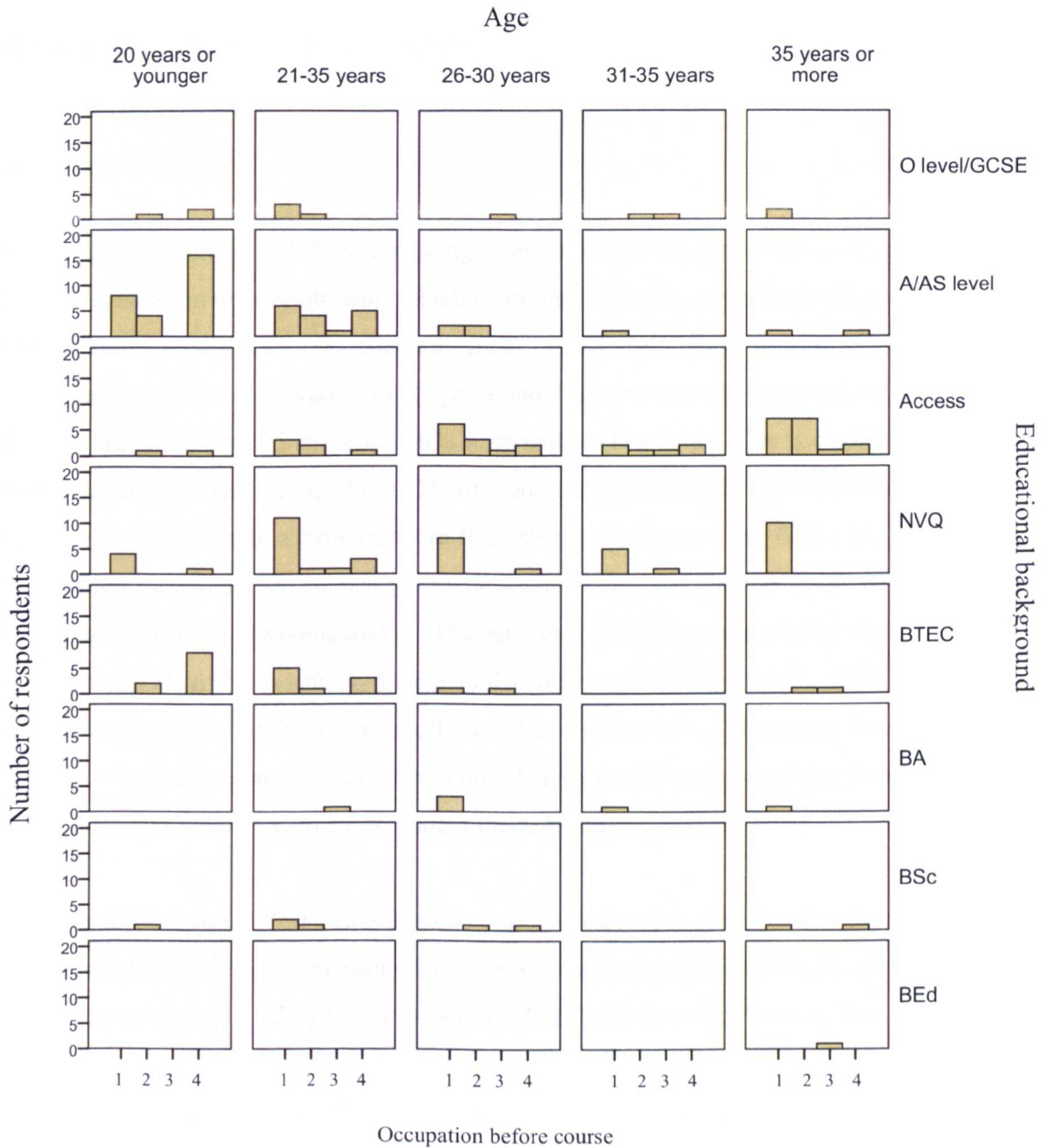


Figure 4.4: Panel display of the demographic variables educational background, age and occupation before course.

Key for occupation before course:

- 1 - Health care assistant – hospital health care support worker, paid home carer, childcare or residential worker.
- 2 - Manual work, plant or machine operator, building work, clerical, secretarial or administrative work, sales occupations.
- 3 - Manager or administrator, professional occupation, engineer, teacher.
- 4 - No previous occupation or full time parent.

4.4 Discussion of Sample Characteristics

4.4.1 Age and Gender

The age demographic profile bore a striking resemblance to Ofori's (2000) study of 222 pre-registration nursing students which examined age and entry qualifications as predictors of assessment success. Students under twenty years of age formed 15% of the total respondents, 41% were over 25 years and 7% were male. By comparison, 44% students were over 25 years and 10% were male in this study. This is comparable to Prymachuk *et al* (2009), in which 15% of students in a sample of 1259 were male attending an institution in a large northern English city. In *Nursing our future* (RCN 2008) which surveyed 4500 student nurses between August and October 2008, 47% were over 30 years of age compared to 28% here, and 19% were over 40. It is also reported that 17% of those surveyed were 35-40. Without additional details of the RCN study sample it is difficult to hypothesise the origin of these differences, but it could be a result of regional variation or more likely, a result of the sampling strategy and bias, limited to those with RCN student membership.

A notable difference to Ofori's (2000) study was in the number of students under 20 years who made up 25% of this sample. Correspondingly, the numbers of students in the next age category, 21-25 years, were 41% in Ofori (2000) and 28% here. This could be possibly be explained by a difference in how the data were collapsed into the categories which in Ofori (2000) were less than 20 years, 20-24, 25-29, 30-34 and older than 34 years. The one year difference in the categories could account for the difference in the percentages in each age group, but despite this, the age profiles of the students in the two studies were very similar. Prymachuk *et al* (2009) did not report the age profile, but do report the mean was 26 years, which is in agreement with the modal age category here. Through comparison with other studies, it could be argued the age profile of the students in this sample was reasonably representative of the population, and by extension of this argument, any conclusions made on the basis of age would be valid.

In terms of predicting academic success, age on entry has been found to have a small effect on course completion with 'older' students, *mdn* = 24 years, more likely to complete than younger students, *mdn* = 21 years (Pryjmachuk *et al* 2009). These are consistent with Ofori's (2000) findings which indicated students less than 20 years old performed less well in psychologically focussed module assessment than the more mature students. Although Ofori's (2000) study has a narrower focus, it adds weight to the evidence that age is a predictor of success in the course.

There is a clear difference between the age demographic in this study and Ofori (2000) when compared to Murray and Chambers' (1990) study of the characteristics of student nurses. They reported 76% of the sample entering a college registered general nursing (RGN) course and 85% undergraduate nursing course entering were under twenty years old. Just 2% were over thirty years when entering the college course and there were no students in that age range entering the degree route to registration (Murray & Chambers 1990). It should be noted the sample was drawn from students in a college in Northern Ireland which, in their words, 'present[s] the traditional image of the nurse'. However, this serves to illustrate the changes in the age profiles of the cohorts of student nurses in these studies and this research.

4.4.2 Marital Status and Caring Responsibilities

One further demographic factor reported by Murray and Chambers (1990) was that 2% (3/114) of the students, all in the RGN college sample, were married. Marital status was not considered for inclusion as a demographic item in this study because the information this could provide would be limited in scope in terms of how it relates to student learning. A simple dichotomous question would not reflect that relationships are not always founded on marriage. Also, it would not reflect student caring responsibilities because unmarried students could be just as likely to have social responsibilities in the form of dependents or caring roles at home or in the family.

The grounded theory findings could reveal students who did not have children of their own or were in the younger age groups may still have caring or social responsibilities

for other family members that could impinge on their time or environment for study. This is important in relation to studying because students attending urban universities with a high proportion living at home have the lowest average study hours (Gibbs 2010). Arguably, this is an area that needs further investigation and research questions could focus on investigating how age and caring roles at home have an effect student learning with respect to impact on studying. This would be an informative area for future research given the demographic profile of student nurses, and students entering higher education in general. This is a somewhat neglected area, but there is initial exploration in nurse education literature in relation to completion of the course with respect to gender roles (McLaughlin *et al* 2009) and the experience of mature women on nursing programmes (Kevern & Webb 2004).

4.4.3 Sample Profile: Prior Occupation

It was no surprise based on previous anecdotal evidence and experience to find that the majority of students indicated they had worked in a care-related role prior to commencing the nursing programme. The category with the next highest number of responses was no previous occupation or fulltime parent, which could be considered to be the choice for students or school leavers prior to starting the course. However, this assumption that students or school leavers indicated they were in no previous occupation signifies an area where improvements to this aspect of questionnaire could be made, particularly with regard to the full time parent category. Additional categories would provide more detailed information about previous occupation. Nevertheless, the general picture from the survey sufficed for the purpose of this study in light of subsequent findings in relation to this demographic.

These results can be compared with *Nursing our future* (RCN 2008) in which 65% of students were in paid employment prior to the course, 21% with the NHS and 40% in other paid employment. It was found that 30% were students at school or college and 7% had caring responsibilities at home (3% full-time child care and 4% other caring responsibility). The RCN (2008) report has more information about caring responsibilities than here, but does not expand on the types of paid employment the students left before commencing their courses.

The trellis display (figure 4.4) provided more detail for this picture demonstrating students with A/AS levels are clustered in the under 20 and 21-25 years age groups. Although not a direct function of previous occupation, it should be noted that in an Australian study, part-time employment involving more than 16 hours per week was negatively associated with academic performance (Salamonson & Andrew 2006). If it is hypothesised that part-time work impinges on study time, then it is likely it would impact on student perceptions of their study approaches. As is discussed later, only 17% of the students indicated surface approaches to studying and less well developed epistemological beliefs which could be a result of the student bursary. Anecdotally, we know many of our students have to go to work part-time, but an item to address this issue might have provided additional information to inform the results of this study.

4.4.4 Sample Profile: Educational Background

One of the most striking aspects about the students' educational background was the wide variety of qualifications held which emphasised the diversity of the students in this sample. Furthermore, in terms of the sample, it could be argued this was an indicator of heterogeneity.

The demographic variables were the focus of the initial exploration of the data in relation to instrument scores. The next sections of this chapter focus on the factor analyses of the rEBI and ASSIST. These are reported in detail because of issues in establishing the factorial validity and reliability of the instruments, an important element of the analysis to contribute to answering the first research question.

4.5 Exploratory Factor Analysis of the revised EBI

4.5.1 Initial Procedures and Factor Extraction

The initial exploratory factor analysis used PCA procedures. The Kaiser-Meyer-Olkin (KMO) result was 0.681, which exceeded the recommended value of 0.5, and Bartlett's test of sphericity was significant [$\chi^2(253, N = 188) = 729.25, p < .001$] which indicated the dataset was suitable for factor analysis. Communalities were wide, ranging 0.42 to 0.80 and the mean communality was 0.59 (appendix 8, table 3), which indicated the sample size was adequate for exploratory factor analysis (Field 2005).

A point of inflection after the fifth component was apparent from the scree plot of eigenvalues (Cattell 1966) indicated in figure 4.5. Parallel analysis (Hayton *et al* 2004) calculated using a recognised syntax (O'Connor 2000) also indicated five factors should be retained (appendix 8, figure 2 and table 4).

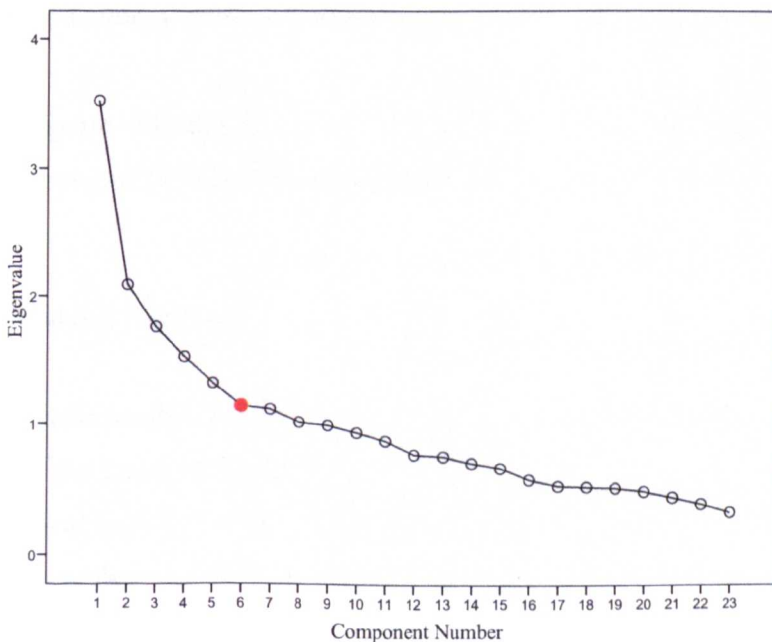


Figure 4.5: Scree plot of eigenvalues following PCA of the revised EBI.

4.5.2 Factor Rotation

Varimax rotation resulted in a five-factor orthogonal structure explaining 45% of variance (appendix 8, table 5). The structure demonstrated in table 4.3 shares some consistency with that of the original EBI findings in Schraw *et al* (2002) and in the pilot of the EBI in this research. However, the loadings on the fourth and fifth components were items mainly concerned with simplicity of knowledge, which were labelled SK1 and OA/SK2. A four factor solution explaining 38% of the total variance appeared more parsimonious and indicated further analyses of the four subscales and a subsequent CFA were appropriate. A similar five-factor result was obtained with a polychoric matrix input (appendix 8, table 6), but the fourth and fifth components appeared less distinct with only one high loading on the fifth component and cross-loadings were apparent.

Factor analysis using maximum likelihood (ML) extraction resulted in three and four factor solutions. The goodness-of-fit chi squares were:

Three factor: $\chi^2(187, N = 188) = 247.6, p = .002, \chi^2/df = 1.32$

Four factor: $\chi^2(167, N = 188) = 194.1, p = .074, \chi^2/df = 1.16$

The lower chi-square indicated the four-factor solution was more acceptable and reinforced the previous PCA results and solution.

4.5.3 Factor Analysis Summary

To summarise these results, the four factor structure chi square indicated a more acceptable fit of the data which explained 39% of the variance and was in agreement with the theoretical basis of the model proposed by Schommer (1990). The explained variance was lower than the 60% of variation explained in the original Schraw *et al* (2002) validation study, but it was almost identical to the pilot study results and this aspect of the factor analysis will be discussed in greater depth further in the chapter. None of the factor analyses demonstrated a clear certain knowledge factor, and the only loading above 0.4 on this subscale appeared in factor 2, quick learning. Item 2

'what is true is a matter of opinion' (q02) loaded below 0.3 on factor 3, omniscient authority. Item 16 loaded highly on factor five, but did not contribute to the subscale reliability (table 4.3) so was omitted from the calculation of subscale mean. Question one 'most things worth knowing are easy to understand' cross loaded onto two components, SK1 and OA/SK2.

Table 4.3: Component matrix after PCA extraction of five factors with varimax rotation.

Item	Component				
	1	2	3	4	5
q20 clever people are born that way	.74				
q05 people's intellectual potential is fixed at birth	.64				
q10 some people are born with special gifts and talents	.58				
q06 really clever students don't have to work as hard to do well in school	.57				
q13 some people just have a knack for learning and others don't	.54				
q11 how well you do in school depends on how clever you are	.50				
q18 the more you know about a topic, the more there is to know					
q17 if you haven't understood a chapter the first time, going back over it won't help		.73			
q12 if you don't learn something quickly you won't ever learn it		.69			
q15 if two people are arguing about something, at least one of them must be wrong		.66			
q23 working on a problem with no quick solution is a waste of time		.59			
q19 what is true today will be true tomorrow		.42			
q22 people shouldn't question authority			.75		
q04 people should always obey the law			.71		
q21 when someone in authority tells me what to do, I usually do it			.66		
q03 students who learn quickly are the most successful			.38		
q02 what is true is a matter of opinion			.25		
q07 too many theories just complicate things				.69	
q09 lecturers should focus on facts instead of theories				.61	
q14 things are simpler than most lecturers would have you believe				.50	
q16 children should be allowed to question their parents' authority					.74
q01 most things worth knowing are easy to understand				.51	.53
q08 the best ideas are often the most simple					.42
Factor label	IA	QL	OA	SK1	OA/ SK2

4.6 Confirmatory Factor Analysis of the revised EBI

4.6.1 Initial Analysis

Confirmatory factor analysis of the complete revised EBI item-level dataset indicated a relatively poor fit of the data to the original five-factor model hypothesised by Schraw *et al* (2002). The fit indices were $\chi^2 (220, N= 188) = 320.3$, $\chi^2 / df = 1.46$, $p < .001$, RMSEA = 0.05, which were acceptable, but there were several low standardised estimates which indicated the five-factor model did not adequately fit the data commensurate with the EFA findings (appendix 8, figure 3). Three- and four-factor models were analysed on the basis of theoretical indications and previous findings in the literature in order to find the most parsimonious and acceptable CFA solution to support further analyses of the dataset.

When the data were subject to CFA as suggested by the ML EFA structures, a three-factor model with more acceptable fit was achieved after trimming low loading items (fit indices summarised for all models in table 4.4). This was repeated with weighted least squares (WLS) estimation, recommended as an alternative extraction technique for ordered categorical data (Finney & DiStefano 2006).

This procedure was repeated for the four-factor model derived from PCA with factors SK1 and SK2 combined using 16 items from the original 23 (figure 4.6). The goodness of fit indices are summarised in table 4.4 and are very similar to the three-factor model indices. However, this four-factor model was more acceptable on the basis of the χ^2 / df ratio.

Table 4.4: Summary of fit indices from the confirmatory factor analyses of the revised EBI subscales and comparing three and four factor models using ML and WLS extraction methods.

	χ^2	<i>p</i>	χ^2 / df	RMSEA	90% confidence interval	<i>P</i> _{close}	CFI	GFI	AGFI	SRMR
3 factor ML 13 items	$\chi^2 (62, N = 197) = 91.8$.008	1.48	0.050	0.03 ; 0.07	.49	0.93	0.93	0.90	
3 factor WLS 13 items	S-B $\chi^2 (62, N = 197) = 106.2$	< .001	1.71	0.060	0.04 ; 0.08	.19	0.97	0.95	0.93	
4 factor ML 16 items	$\chi^2 (113, N = 197) = 154.85$	< .001	1.37	0.053	0.04 ; 0.07	.38	0.91	0.91	0.88	
4 factor WLS 16 items	S-B $\chi^2 (113, N = 197) = 182.64$	< .001	1.62	0.056	0.04 ; 0.07	.24	0.97	0.94	0.92	0.09
4 factor WLS 14 items	S-B $\chi^2 (71, N = 188) = 72.96$.41	1.03	0.012	0.0 ; 0.05	.98	0.98	0.96	0.94	0.08

Legend:

ML – maximum likelihood

WLS – weighted least squares

S-B χ^2 – Satorra-Bentler corrected chi-square (reported for WLS models)

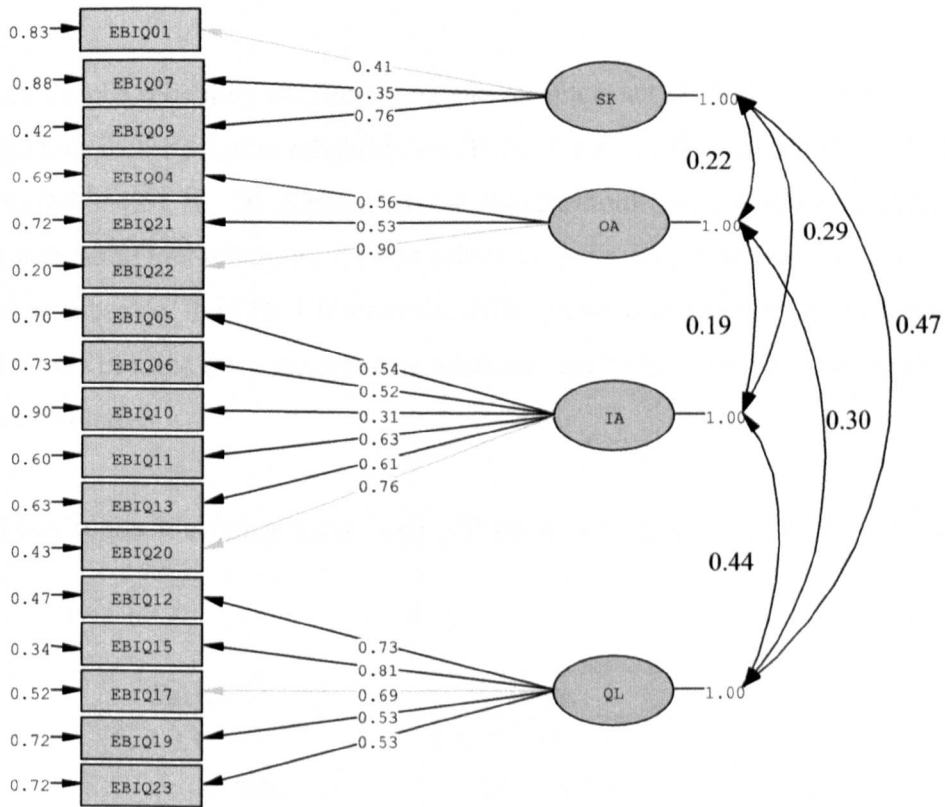


Figure 4.6: Diagrammatic representation of the CFA of revised EBI four factor model demonstrating items retained following trimming and standardised estimates.

4.6.2 Improvement of Model Fit

Further exploration and modification of the model was undertaken by eliminating items with low loadings and high standardised residuals (> 2.58 or < -2.58) which resulted in 14 items being retained in the final CFA and produced a non-significant chi-square. However, it should be noted the OA factor was reliant on one indicator only.

Further discussion of the meaning of these findings will be made later in this chapter, but on the basis of these confirmatory analyses producing a non-significant chi-square and the acceptable fit indices, a four factor model was adopted for further procedures. This reinforced the previous exploratory results.

4.7 Revised EBI Scale Reliability Analysis

Cronbach's alpha reliability coefficient for the complete set of 23 rEBI items was .703. The four factor solution reliability coefficients are low for the OA, QL and SK subscales (table 4.5), but QL approached the .70 threshold. The CK subscale alpha was .29 indicating low reliability for that subset of items, therefore this was not included as subscale. Item 16 'Children should be allowed to question their parents' authority' was omitted from the subscale reliability analysis on the basis of the EFA and CFA results.

Table 4.5: Cronbach's alphas for revised EBI subscales based on the EFA four factor solution.

Factor	Items	α
IA	5, 6, 10, 11, 13, 20	.69
SK 1 & OA/SK2	1, 7, 8, 9, 14	.51
OA	4, 21, 22	.59
QL	12, 15, 17, 19, 23	.66
CK	2, 15, 19	.29

This reliability analysis can be contrasted with DeBacker and Crowson (2006) who found internal consistency for the EBI subscales were SK 0.59; CK 0.64; OA 0.55 and 0.68 when combined. This adds weight to the EFA findings and supports the contention that the student personal epistemologies elicited by the rEBI consist of four main dimensions. Furthermore, they are suggestive of the possibility that certainty and simplicity of knowledge are much finer-grained and might not be discernable by the items on the rEBI. On the basis of the factor analyses SK1 and OA/SK2 will be considered to be one dimension which will be labelled simple knowledge.

4.8 Exploratory Factor Analysis of ASSIST and Scale Reliability

Exploratory factor analysis of the ASSIST data was at item and subscale level using ML extraction and oblique rotation, which allowed for the factors to be correlated as in Tait *et al* (1998). The KMO result was 0.77 and Bartlett's test was significant [$\chi^2(2145, N=197) = 12254.9, p < .001$] indicating the data were suitable for factor analysis. Communalities were wide ranging from 0.44 to 0.74 ($M = 0.604$ - see appendix 8, table 7). Cronbach's alpha values were .75 to .87 indicating high levels of internal consistency similar to the findings reported by Tait *et al* (1998).

Following oblique rotation, a three-factor structure explained 52% of variance with all the original ASSIST subscales present (table 4.6 and appendix 8, table 8). The outstanding feature was the lack of purpose loading on the deep approach factor, but this loading was negative, so fitted theoretical expectations. There were also cross-loadings between the organised study, monitoring effectiveness and achieving subscales on the deep and strategic approach factors. However, the organised study loading was less than 0.4 on the deep factor and the highest loadings for the monitoring effectiveness and achieving subscales were on the strategic factor, justifying inclusion in the analysis. Time management was the highest loading subscale (.91) and was correlated positively with a strategic approach (.78, $p < .001$) and negatively with surface approaches (-.23, $p = .002$).

Correlations between the factors are reported in table 4.7. The low correlation between deep and strategic approaches is unsurprising because it is not unreasonable to presume they share some features conceptually and the insignificant correlations between deep and surface and strategic and surface approaches were not unexpected. When the EFA procedure was repeated with varimax rotation, there were few substantial differences noted between the matrices from the two procedures (appendix 8, table 9), so the oblique interpretation was taken to be the most parsimonious theoretically. On the basis of this factor analysis, factor one was labelled 'tendency to a deep approach', factor two, 'tendency to a surface approach' and three, 'tendency to a strategic approach'. These are abbreviated for convenience in table 4.7 and later analyses.

Table 4.6: Factor pattern matrix and Cronbach alpha values for ASSIST subscales.

Loadings less than 0.3 suppressed.

Subscale	Factor 1 Tendency to a Deep Approach	Factor 2 Tendency to a Surface Approach	Factor 3 Tendency to a Strategic Approach	α
<i>Deep approach</i>				.87
Use of evidence	.82			.60
Relating ideas	.79			.58
Interest in ideas (AM)	.78			.87
Seeking meaning	.54			.69
<i>Surface approach</i>				.75
Lack of purpose	-.48			.53
Fear of failure (AM)		.77		.78
Syllabus boundedness		.48		.63
Unrelated memorising		.43		.48
<i>Strategic approach</i>				.78
Alertness to assessment demands		(.40)		.61
Time management			.91	.78
Organised study	(.36)		.72	.4
Monitoring effectiveness (AM)	.44	(.30)	.44	.75
Achieving (AM)	.42	.41	.50	.69
<i>Preferences for teaching</i>				
Supporting understanding	.51			.75
Transmitting information	(.32)	.40		.73
<i>Conceptions of learning</i>				
Instrumental	(.37)			.58
Understanding	(.35)			.74

Key – AM: associated motive or extra subscale to main scale.

Bracketed loadings < .4 included to demonstrate cross-loadings.

Table 4.7: ASSIST factor correlation matrix

Factor	1	2	3
1 Deep approach	1.000		
2 Surface approach	.04	1.000	
3 Strategic approach	.25	.03	1.000

4.9 Confirmatory Factor Analysis of ASSIST

Item level CFA resulted in $\chi^2(1271, N = 197) = 3298.2, p < .001, \chi^2 / df = 2.59$, RMSEA = 0.11, CFI = 0.81 and there were several high standardised residuals which indicated a poor fit of the data to the model. Following CFA of the subscale mean totals based on the EFA findings (figure 4.7), the following fit indices were obtained: $\chi^2(62, N = 197) = 293.59, p < .001, \chi^2 / df = 4.74$, RMSEA = 0.15 (90% confidence interval 0.13; 0.16), $pclose < .001$.

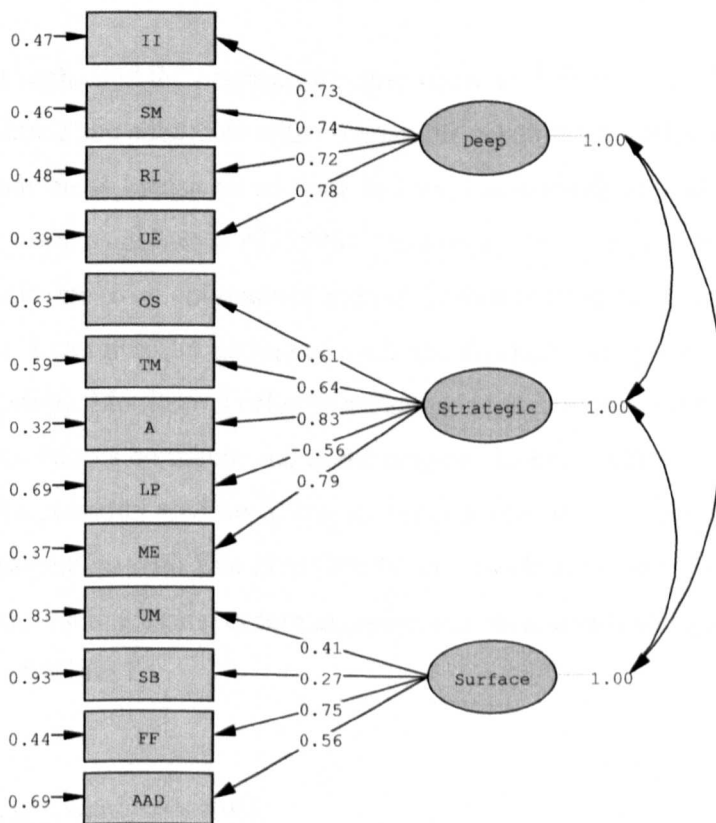


Figure 4.7: Confirmatory factor analysis of ASSIST using subscale scores.

When the lack of purpose subscale was allowed to load onto the surface approach as in the original Tait *et al* (1998) model, the fit indices were $\chi^2(62, N = 197) = 302.63, p < .001, \chi^2 / df = 4.9$, RMSEA = 0.15 (90% confidence interval 0.13; 0.17), $pclose < .001$. These fit indices indicated the fit of the data to the model was still not satisfactory and on this basis, the model could be rejected. The three subscales were

modelled separately and redundant items removed on the basis of low loadings or high standardised residuals. A final CFA of a three factor model using a reduced set of 23 items resulted in $\chi^2(227, N = 197) = 442.76, p < .001, \chi^2 / df = 1.95, RMSEA = 0.062$ (90% confidence interval 0.052; 0.072), $pclose = 0.026, CFI = 0.94, SRMR = 0.081$ which indicated more acceptable fit of the data to the model.

4.10 Factor Analysis Discussion

4.10.1 Factor Replication

The EFA results replicated the original structure found in Tait *et al* (1998) with a clear three-factor structure and subscales with comparable reliability coefficients. The achieving subscale cross-loaded on all three factors, but the highest loading was on the strategic approach as in Tait *et al* (1998). On closer inspection, the subscale items appear to be applicable to all approaches and not exclusive to one or the other, for example item 24 'I feel that I'm getting on well and this helps me put more effort into the work' (achieving). Monitoring effectiveness loaded at just acceptable levels across deep and strategic factors both here and in the original Tait *et al* (1998) analysis indicating this is a potential area for instrument improvement. The subscale reliability results were in agreement with Zhu *et al* (2008a) cross-cultural study of Flemish and Chinese educational sciences and communication studies students using a shortened 18 item version of ASSIST.

4.10.2 Confirmatory Analysis - rEBI

The EFA results from both the EBI pilot and main rEBI study indicated five factors after PCA, which were similar factor structures to the original EBI factors in the Schraw *et al* (2002) validation study. However, the rEBI five-factor solution had very similar fourth and fifth factors, labelled simple knowledge 1 and 2. The two factors were combined for further analyses on the basis of the ML EFA results which suggested a four-factor solution, and this was given further justification by the CFA findings. The certainty of knowledge subscale, CK, was not particularly well

developed and the low alpha for this scale indicated poor reliability. Furthermore, certainty of knowledge items loaded onto one factor with quick learning items in the ML analysis. On the basis of these findings, arguably certainty and simplicity of knowledge and speed of knowledge acquisition could be considered aspects of one dimension, or alternately, these beliefs may be finer grained and more multidimensional, thus the inventory is not sufficiently sensitive to discriminate between them. What adds weight to this conclusion is the inventory did discriminate between this group of factors (QL/CK/SK) and the innate ability and omniscient authority factors.

4.10.3 Relationship to Previous Studies

The analysis results were similar to those in Schommer *et al* (1992) when a four-factor EFA solution for the EQ was produced after modifying the procedure used to extract factors and a four factor structure was found after CFA. The overall results from the rEBI analyses were in agreement with DeBacker *et al* (2008) who had difficulty replicating the five-factor structure and reported issues of low internal consistency of the subscales and with Bråten and Strømsø (2005) who found a four-factor structure when studying post-secondary education students. Recent work by Ordoñez *et al* (2009) have added further weight to these findings through their development of the EQ and CFA of the EBI which resulted in a four-factor inventory, the EQEBI.

4.10.4 Confirmatory Analysis - ASSSIST

Similar issues were encountered during the CFA of the ASSSIST data as reported for the rEBI, which initially produced an inflated chi-square and required extensive trimming to obtain adequate fit indices. However, these results are in agreement with Zhu *et al* (2008b) although they reported an RMSEA of less than .06.

4.10.5 Methodological Issues

The EFA and CFA analyses were technically difficult elements of the survey analysis in terms of conducting the procedures and interpretation of the results because of the rapidly changing nature of the field. However, they were necessary because the procedures provided tentative answers to the questions about validity and how many dimensions were present in the student responses to these survey instruments. These could then be used for translation of raw scores into subscale scores. The exploratory factor analysis stage could have been theoretically omitted and CFA justified as the method of choice, but, the EFA stage was justifiable because of limitations in the original Schraw *et al* (2002) study, the redesign of the rEBI and also because it is not an uncommon approach in the literature (Cano 2005). Arguably, using current custom and practice as justification for using methods is not necessarily best practice, but it should be noted that EFA within CFA and structural equation modelling is an emergent field being with techniques being developed to counter the problems encountered during CFA in situations such as in this study (Marsh *et al* 2009). CFA in the context of nursing practice research has been forwarded as a means to empirically test and develop theory (Kääriäinen *et al* 2011).

The sample sizes of the pilot ($N = 286$) and main study ($N = 197$) were somewhat larger than the original Schraw *et al* (2002) study sample ($N = 160$). It is reasonable to hypothesise that nursing students from the United Kingdom could be different enough in terms of their personal epistemologies and higher education culture to the psychology students from a Midwestern university in the United States. This warranted replication of the original study using EFA then CFA methods. Also, the Schraw *et al* (2002) sample were arguably more homogenous than this sample of student nurses who demonstrated heterogeneity in terms of their demographic characteristics.

4.10.6 Factor Analysis Concluding Comments

The issues that arose whilst fitting the CFA models in this study (inflated chi-squares and high standardised residuals) are not unusual when EFA developed models are tested and could be due to various causes including sample size and measurement error or non-normality because of the use of Likert scales, but also, because of the stringent nature of the CFA procedure (Marsh *et al* 2009). Therefore, the final CFA results should be treated cautiously, but they were in general agreement with previous and more recent work on epistemological beliefs (Bråten & Strømsø 2005) and approaches to studying (Mansouri *et al* 2006). Mean or median subscale scores derived from the four factors were used for subsequent analyses of the participant responses. The next sections will utilise the information from these factor analyses and focus on the student differences within the data in relation to the instrument subscale scores and the demographic variables.

4.11 Analysis of the rEBI and ASSIST Scores

4.11.1 Statistical Model based on the Mean

The instrument scores provided a means to answer the research questions in relation to describing the characteristics of student nurse personal epistemologies and approaches to studying. The survey instrument scale total and mean subscale scores (table 4.8) were derived from scales from the factor analyses and according to the validation studies. These were calculated using the compute new variable function in SPSS and raw scores are presented in appendix 8, tables ten and eleven. The scores are analysed in depth in sections 4.13 and 4.14.

Table 4.8: Mean total and subscale scores and measures of skew and kurtosis.

Scale Score	<i>M</i>	<i>SD</i>	skew	<i>p</i>	kurtosis	<i>p</i>
rEBI total (min 39, max 89)	64.8	9.6	.25	.20	-.23	.67
Certain knowledge (CK)	2.15	0.68	.56	.005	.30	.87
Simple knowledge (SK)	3.32	0.66	-.12	.35	-.09	.86
Quick learning (QL)	1.75	0.62	1.11	<.001	1.98	<.001
Omniscient authority (OA)	3.30	-.26	-.22	.97	-.50	.06
Innate ability (IA)	2.85	0.75	.05	.89	.22	.31
ASSIST total (min 102, max 225)	176.2	20.3	-.59	.002	1.45	.01
Deep	3.53	0.62	-.77	.000	1.5	.01
Strategic	3.56	0.62	-.55	.004	.18	.49
Surface	3.02	0.53	-.10	.59	.05	.87
Final ASSIST question	5.64	1.36	-.40	.04	.83	.05

Mean scores and standard deviations with measures and tests of skew and kurtosis for the rEBI and ASSIST total and subscale scores (table 4.8) determined the appropriate inferential tests that could be used to compare group differences; $p < .05$ indicates significant skew or kurtosis. It was apparent from the tests that the deep, strategic and certain knowledge and quick learning subscales were significantly non-normal using this criterion. It was not possible to obtain normal distributions after using log or

square root transformations, although visual inspection of distributions is recommended as an appropriate approach for assessing normality in larger sample sizes (Field 2005). The deep and strategic scores appeared skewed to the right when plotted and the quick learning subscale, skewed to the left, which indicated these subscales could not be used reliably in parametric analysis of variance (ANOVA) where a normal distribution is assumed. Therefore, non-parametric tests were used when these subscales were analysed.

4.11.2 ASSIST Scores

The highest of the subscale scores on ASSIST was used to indicate the main study approach taken by each individual in the total survey sample ($n = 177$, missing $n = 20$, 10%). This indicated:

- An overall tendency to a strategic approach to studying (82 students; 46%);
- Over a third indicated a tendency for deep approaches (64 students; 36%)
- The minority indicated surface approaches (31 students; 18%).

The last ASSIST question ‘Finally, how well do you think you have been doing in your assessed work overall, so far?’ was a Likert scale of 1 – 9 presented reversed as 9 -1 ‘very well’ to ‘rather badly’ (figure 4.8). The mean score was 5.6 ($SD = 1.36$).

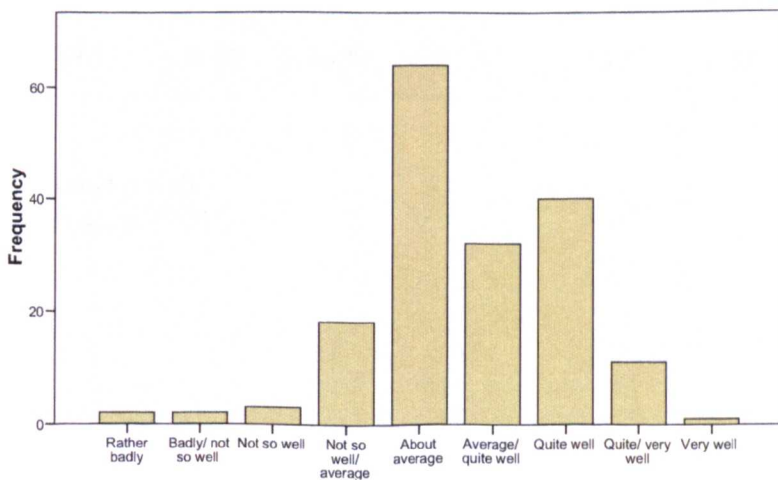


Figure 4.8: Response to final ASSIST question.

4.11.3 Correlation Analyses

Spearman's rho correlations are reported in table 4.9. Medium, but significant, positive correlations between the rEBI and ASSIST surface subscale scores were found. These correlations could reasonably be expected because higher rEBI mean scores are compatible with a surface approach focused on memorisation and acquisition and reproduction of facts. There was also a significant correlation between the OA and strategic subscales.

Table 4.9: Correlations between ASSIST and rEBI subscale scores.

Subscale mean score	OA	SK	QL	IA	Deep approach	Strategic approach	Surface approach
OA	1.0						
SK	.15*	1.0					
QL	.10	.29 **	1.0				
IA	.16*	.27 **	.21 **	1.0			
Deep approach	.12	.05	-.06	-.08	1.0		
Strategic approach	.22 *	.06	-.02	-.09	.55 **	1.0	
Surface approach	.19 *	.30 **	.26 **	.27 **	-.19 *	-.20 *	1.0

Key: * represents $p < .05$.
 ** represents $p < .001$.

The strong and significant correlation between the deep and strategic approach subscale scores $r_s(166) = .55, p < .001$ was consistent with the theoretical structure of ASSIST. By contrast, the surface approach subscale scores were significantly negatively correlated with the deep and strategic subscale scores.

4.12 Section Summary – Sample Profile and Data Characteristics

To summarise, the descriptive analyses of the demographic and questionnaires provided details about this sample of students in terms of age, occupational and educational backgrounds and their position on the course.

- The age profile of students in this study was comparable to previously published research. The majority of students were under 30 years of age and a significant number of students were in the 35 years or over age group. The percentages of male and female students were similar to other studies of student nurses.
- The majority of the students (61%) held A/AS level, NVQ or ACCESS qualifications and had backgrounds in care-related work or had entered from school or full-time parenting roles. Students in the older age categories tended to hold an access qualification and younger students, a BTEC, whilst the NVQ qualification was held by students in all age groups.
- Most of the students in the sample were in CFP (63%) and the remainder were in Branch (72) which was a reflection of the distribution of students with the school.
- When the datasets were examined for errors and normality, the amount of data missing from the rEBI was acceptable (< 5%) and the quick learning subscale was skewed. The ASSIST had a significant amount of missing data (6%) and the deep and strategic approach subscales were skewed. Non-normality of the subscales indicated non-parametric tests would be more powerful and appropriate for subsequent inferential analyses. This also indicated factor analyses results should be treated with a degree of caution, although ML estimation is regarded as robust to the violation of assumption of normality (Marsh *et al* 2004).

- The epistemological beliefs about the nature of knowledge (simple knowledge) and the nature of learning (quick learning, innate ability and omniscient authority) were significantly correlated, although the correlations were small to medium. There were small to medium correlations between all four epistemological beliefs and a surface approach to studying.
- The strategic dominant study approach was strategic (46%), followed by a tendency for deep (36%) and surface approaches (18%). Study approaches were significantly correlated, surface weakly and negatively with strategic and deep approaches, and deep and strategic strongly correlated. In other words, 1 in 5 students in this research indicated a tendency to surface approaches to studying with the remainder roughly evenly split between deep and strategic.
- These findings can be contrasted with Mansouri *et al* (2006) where 64% of students indicated deep, 22% surface and 13% strategic approaches, the last of which was associated with the highest GPA. The percentage indicating a surface approach is roughly similar across the two studies.

Exploratory and confirmatory factor analyses indicated:

- A four-factor model was the most appropriate interpretation of the structure of epistemological beliefs from the rEBI. This was supported by reliability analysis of the subscales, although the number of items in the certain knowledge subscale had been reduced after the pilot study.
- The EBI factors were not as clear cut as the five reported by Schraw *et al* (2002) which was in agreement with other international studies (Jehng *et al* 1993, Chan & Elliott 2002, Bråten & Strømsø 2005, Siteo 2006). Certain knowledge items did appear to a limited extent with low loadings on innate ability, quick learning and omniscient authority. The fifth factor was not substantially different from simple knowledge, but did have a significant loading item from omniscient authority.

- The structure of the ASSIST indicated by EFA replicated the original study findings and explained 52% of variance, but the three factor structure was difficult to establish using CFA, although this finding is comparable with other studies.
- Confirmatory analyses produced acceptable fit indices when several items were trimmed from the model and potential reasons for the difficulty in fitting the data to the models have been considered.

The following sections of the analysis are concerned with how different groups of students became apparent during the analysis. Knowing descriptive information such as the mean instrument scores and variances for the sample as a whole is useful, but does not permit meaningful comparisons between participants. Cluster analysis techniques provided the means to probe deeper into the dataset and revealed information about sub communities of participants and their personal epistemological beliefs and approaches to studying.

4.13 Cluster Analysis of Student Groups

Cluster analysis enabled further exploration and profiling of the group differences between student responses to the questionnaires. Cluster analysis was an appropriate procedure both in the overall quantitative data analysis and the context of this research because of the ability of the procedure to focus on groups of individuals, rather than the previous focus on groups of variables, which was the aim of the factor analyses. Ward's hierarchical clustering technique was used to minimise the variance between cases through an ANOVA approach to evaluate distances between clusters and because it is an efficient procedure to produce a small number of easily interpretable clusters (Everitt *et al* 2001). A dendrogram and the agglomeration schedule provided the basis for deciding the appropriateness of a three-cluster solution indicated by this procedure (appendix 8, figure 4). The three clusters were also reproduced by K-means analysis thus emphasising the validity of the Ward's procedure results.

4.13.1 Verification of Clusters

Two differing methods were used to define the cluster group membership because cluster analysis does not provide significance testing or verification. Discriminant function analysis (Field 2005) was performed to validate the cluster analysis. The discriminant functions were both statistically significant (appendix 8, table 12) and predicted group membership was accurate for 93.1% of cases (table 4.10).

Table 4.10: Discriminant function analysis cluster classification results.

Cluster	Predicted group membership (%) and number of cases in group		
Group 1	95.7%	4.3%	0
	44	2	
Group 2	6.9%	89.7%	3.4%
	6	78	3
Group 3	0	0	100%
			27

Multinomial logistic regression was used to verify the cluster analysis because it is recommended as a more robust approach when data are non-normal and when the categorical indicator (in this case, cluster membership) has more than two categories (Peng *et al* 2002). The total ASSIST score and rEBI subscale mean scores were entered into the regression which resulted in the classification table in table 4.11.

The overall fit of the multinomial logistic regression model was acceptable; $\chi^2(10, N = 160) = 182.0, p < .001$, with a change in explained variance between the regression and baseline null models (log likelihood) from 312.7 to 130.7. It should be noted that 37 students (19%) were not entered into the analysis because of missing data. The results of the analysis (pseudo R^2 , odds ratios and likelihood ratios) are summarised in appendix 8, tables 13 and 14. The pseudo R^2 indicated the model explained a reasonable amount of variation (approximately 58-79%) by the five variables acting together.

Table 4.11: Multinomial logistic regression cluster classification.

Observed	Predicted			Percent Correct
	Cluster 1	Cluster 2	Cluster 3	
1	32	11	0	74%
2	6	81	3	90%
3	1	4	22	82%
Overall %	24%	60%	16%	84%

The test of usefulness of the multinomial regression model was whether it predicted group membership with a 25% improvement over chance alone (Habibollah *et al* 2009). The estimated proportional by chance accuracy rate was 52% (see appendix 8, calculation 1). If this is compared to the 84% overall percentage classification achieved by the model, there is an improvement in predicting cluster membership exceeding 25%. This result was used to define the membership of each cluster.

4.13.2 Comparisons of Cluster Groups

Non-parametric procedures were used to compare the student groups on the basis of demographic indicators. Relationships between categorical variables and median instrument scores were explored using non-parametric Kruskal-Wallis and Mann-Whitney tests (Field 2005). When the ages of students were compared across the clusters, no significant difference was found $\chi^2(2, N = 157) = .556, p = .75$. This was also the case for educational background $\chi^2(2, N = 156) = 5.70, p = .058$, and previous occupation $\chi^2(2, N = 156) = 1.46, p = .48$ which was consistent with previous results both in this study and the literature.

A Kruskal-Wallis test indicated differences in the median scores on all of the subscales between all three clusters. The results were significant at $p < .001$ for all clusters derived from both the cluster analysis and multinomial regression (appendix 8, tables 15 and 16).

Follow-up comparisons using Mann-Whitney tests for all subscale scores are summarised in table 4.12 and reported in full in appendix 8, tables 17 - 19. Despite the unequal cluster sizes, parametric ANOVAs using Hochberg's GT2 post-hoc procedure to compensate for unequal cluster sizes (Field 2005) were in agreement with the Mann-Whitney tests with significant differences between groups, $p < .001$ (appendix 8, tables 20 - 21).

Table 4.12: Summary of student group comparisons following Mann-Whitney tests indicating significantly different subscale scores.

Groups compared	ASSIST Score	rEBI score	SK median	QL median	
1 & 2	**	***	***	***	
1 & 3	***	***	***	.029	
2 & 3	***	.90	.49	.070	
Groups compared	OA median	IA median	Deep median	Strategic median	Surface median
1 & 2	***	***	.27	.78	***
1 & 3	.09	***	***	***	***
2 & 3	.08	**	***	***	.95

Key:

** denotes significance level $p < .0167$ (Bonferroni correction)

*** denotes significance level $p < .001$

Mann-Whitney tests indicated all three clusters were significantly different with regard to their IA median subscale scores with medium to large effect sizes for clusters 1 & 2 and 1 & 3 respectively (table 4.13).

Table 4.13: Results of comparisons between clusters on the innate ability subscale.

Clusters compared	Medians	<i>U</i>	<i>z</i>	<i>N</i>	<i>p</i>	<i>r</i>
1 + 2	2.50 / 3.0	1114.0	-3.96	133	< .001	-.23
1 + 3	2.50 / 3.33	195.0	-4.67	70	< .001	-.56
2 + 3	3.0 / 3.33	809.0	-2.64	117	.008	-.24

4.14 Descriptions of the Clusters

Tables 4.13 and 4.14 illustrate the significant differences and the areas of similarity, in the median total and subscale scores on the ASSIST and rEBI when the groups of students revealed by cluster analysis and multinomial regression were compared.

Median scores are reported in table 4.14 because Mann-Whitney tests were used, but means are included to assist interpretation. The colour coding has been applied to emphasise the scores that are similar between the clusters (i.e. were not found to be significantly different) to complement table 4.13 and enhance the comparisons made here because they are not straightforward to interpret. The red coding is not shaded because of the overlap between clusters 1 & 3 and 2 & 3 on the QL and OA subscales. The QL subscale scores appeared different between clusters one ($Mdn = 1.20$) and three ($Mdn = 1.60$), but the Mann-Whitney post-hoc comparisons confirmed that the difference in medians was not significant ($U = 405.0, p = .029$). Some interpretation of these findings is included at this point rather than later in the chapter because of the complex relationships demonstrated in table 4.14 and represented visually by a plot of median scores in figure 4.9.

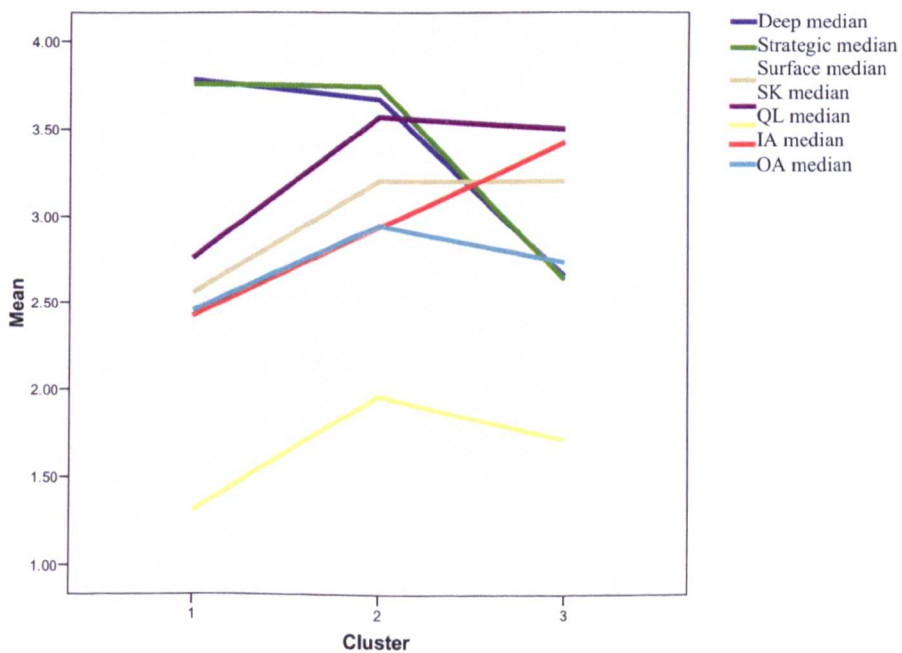


Figure 4.9: Line graph demonstrating differences in cluster subscale scores.

Table 4.14: Median scores on the rEBI and ASSIST subscales for each cluster derived from multinomial regression classification. (Shading indicates cluster subscale scores that were *not* significantly different).

Scale label	Cluster 1				Cluster 2				Cluster 3			
	<i>Mdn</i>	<i>Range</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>Range</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>Range</i>	<i>M</i>	<i>SD</i>
IA subscale	2.50	2.50	2.42	.64	3.0	3.67	2.94	.68	3.33	2.67	3.42	.77
SK subscale	2.80	2.20	2.76	.60	3.60	3.20	3.56	.59	3.40	2.40	3.50	.56
QL subscale	1.20	1.20	1.31	.27	2.0	3.60	1.96	.64	1.60	2.20	1.71	.66
OA subscale	3.0	3.0	2.84	.69	3.67	3.67	3.56	.91	3.33	3.0	3.15	.68
EBI total score	54.0	27.0	54.62	5.14	68.0	38.0	68.36	8.11	67.0	33.0	68.70	8.72
Deep subscale	3.81	2.13	3.78	.52	3.71	2.44	3.66	.46	2.68	2.56	2.66	.62
Strategic subscale	3.80	1.95	3.76	.44	3.73	2.05	3.74	.47	2.65	2.10	2.64	.48
Surface subscale	2.50	1.94	2.56	.43	3.22	2.44	3.20	.44	3.31	2.31	3.20	.57
ASSIST total score	176.0	58.0	176.28	12.60	183.5	71.0	185.21	15.12	150.0	73.0	147.78	19.44

Key:

Blue shading – no significant difference between groups 2 & 3

Yellow shading – no significant difference between groups 1 & 2

Red box – no significant difference between groups 1 & 3

No shading – scores significantly different to other clusters

4.14.1 Cluster One

- Cluster one students ($n = 43$) indicated significantly higher median deep ($U = 79$, $p < .001$, $r = -.72$), strategic ($U = 49.5$, $p < .001$, $r = -.77$) and lower surface approach ($U = 202$, $p < .001$, $r = -.55$) scores than the students in group three with large effect sizes (median scores reported in table 4.14).
- The scores on the deep and strategic subscales were not significantly different to the scores of cluster two. Where cluster one students differed significantly from those in cluster two was in the median surface approach score, which was lower ($U = 6.54$, $p < .001$, $r = -.57$).
- The total rEBI score was lower and significantly different when compared to student scores from clusters two ($U = 257.5$, $p < .001$, $r = -.70$) and three; ($U = 74$, $p < .001$, $r = -.73$).
- When the cluster one rEBI subscale median scores were examined, these students indicated knowledge was less likely to be simple compared to cluster two ($U = 257.5$, $p < .001$, $r = -.70$) and three ($U = 226.5$, $p < .001$, $r = -.48$).
- Knowledge was less likely to be learned quickly or handed down by an authority compared to those in cluster two ($U = 1026$, $p < .001$, $r = -.38$). However, the QL and OA scores were not significantly different to cluster three.
- The cluster one students indicated a significantly lower score on the innate ability subscale. In other words, this could indicate these students had higher levels of belief that the ability to learn is acquired through experience and effort than clusters two and three.

4.14.2 Cluster Two

- As stated above, cluster two member ($n = 90$) scores on the deep and strategic approaches were not significantly different from those indicated by cluster one, but they did score significantly higher on the rEBI score and surface approach subscale ($U = 578, p < .001, r = -.57$).
- When compared to cluster three, the cluster two student rEBI total, SK, QL and OA subscale scores were not significantly different, but the IA score was lower (table 4.15).

These results for cluster two could be interpreted as this group of students had a greater tendency to believe in the simplicity and certainty of knowledge and that it should be acquired quickly and handed down by authority. The IA score was significantly higher than cluster one and significantly lower than the cluster three student score, indicating the students were less likely than cluster one students to believe that the ability to learn is acquired through experience and persistence.

4.14.3 Cluster Three

- The students who were members of cluster three ($n = 27$) indicated significantly lower deep and strategic approach subscale scores than students in clusters one and two and there was no significant difference in the surface approach and overall rEBI scores to cluster two.
- This cluster also reported the highest subscale scores for the IA subscale. The median scores for the SK, QL and OA subscales were not significantly different to cluster two and QL and OA were not significantly different to cluster one. The SK score was significantly higher than indicated by students in cluster one.

In other words, this cluster of students indicated they had more naïve epistemological beliefs in relation to simplicity of knowledge and innate ability than those in cluster one and two and a higher tendency towards adopting a surface approach to studying.

Labelling the student groups on the basis of the instrument scores was not straightforward because a simple classification system masked the complexities and overlapping nature of the reported subscale scores. However, to provide a summary of the results, on the basis of higher scores on the rEBI representing a tendency towards objectivism and lower scores, subjectivism, then cluster one could be labelled deep approach subjectivists, cluster two, strategic approach objectivists and three, surface approach objectivists.

4.15 Time Management

The cluster analysis groups were re-examined in relation to the time management and organised studying subscales of the ASSIST. The subscales are concerned with personal organisation and planning of study time, both short and long term, and the environment and materials for study. The subscales loaded strongly onto the strategic approach factor and the issues present in the items, for example 'I organise my study time carefully to make the best use of it'.

Clusters one and two time management and organised study subscale scores were not significantly different (table 4.15), but cluster three who indicated a higher tendency to a surface study approach indicated scores that were significantly different to clusters one and two. Because this subscale was the highest loading subscale in the factor analysis (.91) and had a strong positive correlation with a strategic approach and a weaker negative correlation with surface approaches, time management is clearly indicated as an important issue in this group of students.

This line of analysis was pursued further in relation to the fear of failure and lack of purpose subscales which appear to be linked with subjective or emotional feelings about study. Whilst these do not contain items specifically related to guilt as such, they are the subscales in the inventory that are concerned with negative emotions about study. Scores from clusters one (*Mdn* = 13) and three (*Mdn* = 14) were significantly different to cluster two (*Mdn* = 17) on the fear of failure subscale (loading .77). In other words, students who indicated a strategic approach to studying were more worried about failure than students in the other groups. The lack of

purpose subscale also indicated differences between all three clusters, with students who indicated a surface approach scoring significantly higher on items which were concerned with worry and trying to cope with too much work.

Table 4.15: Comparisons of clusters on study organisation and subjective subscales of the ASSIST.

Subscale	Clusters compared		
	1 & 2	1 & 3	2 & 3
Time Management	.15	***	***
Organised Studying	.53	***	***
Lack of Purpose	***	***	***
Fear of Failure	***	.65	***
Self-assessment question	**	.25	.24

Key:

** denotes significance level $p < .0167$ (Bonferroni correction)

*** denotes significance level $p < .001$

Self-assessment question: 'Finally, how well do you think you have been doing in your assessed work overall so far?'

The final ASSIST question was included in this analysis to explore how this subjective measure of performance might be related to study approach. The scores indicated that the students who indicated a tendency to a strategic approach self-rated their overall performance lower (cluster 2: $Mdn = 5$) than the other students (clusters 1 & 3: $Mdn = 6$). It is not unreasonable to construct a hypothesis that would include the pressure of juggling several sets of needs simultaneously because of family

responsibilities causing increased concern about failure and a lower self-assessment of performance.

Students who indicated a surface approach self-rated their performance the same as those in the deep approach cluster whilst indicating the highest scores on the lack of purpose and fear of failure subscales. It may be the students in the deep cluster were more modest in their appraisal or it could be the surface cluster students were unrealistic in their self-assessment. For the students adopting a surface approach, thinking they were doing better than they actually were could be a coping mechanism.

4.16 Section Summary - Cluster Analysis

The cluster analysis results were important because they demonstrated variation in students in terms of their approaches to studying and their epistemological beliefs. This enabled grouping together of more homogenous subsamples of individuals within the dataset as opposed to viewing the dataset as a whole or partitioning solely in terms of variables. This 'person-centred' analysis of smaller populations within the larger sample (Ekehammar & Akrami 2003) made these results congruent with the grounded theory approach in the next chapter of this study. To summarise:

- The cluster analysis revealed deeper relationships in the data indicating three sub-communities of students within the main population with approaches to studying and personal epistemologies broadly aligned with the deep, strategic and surface approaches.
- Complex and significant associations between personal epistemological beliefs and study approaches were more apparent using cluster analysis than if approaches to studying were used as the main method to subdivide the student sample.
- Differences between the sub-communities were not clear cut, and there were overlaps in the median subscale scores between the groups of students, indicating the pattern of associations was more subtle than the three clusters suggested.

- Groups of students differed in their personal epistemologies in various ways, but the key indicator that clearly delineated the three clusters was the subscale score indicating beliefs about innate ability, that the ability to learn is acquired through experience and persistence, and thus is modifiable. Cluster one students had the lowest belief in innate ability and simplicity of knowledge compared to clusters two and three and were more likely to indicate a deep approach to study. By contrast, cluster three were more likely to indicate a surface approach to study and higher scores on the innate ability and simplicity of knowledge subscales, but interestingly, they were not different from cluster one with regard to beliefs in omniscient authority and quick learning.
- These differences suggest this is an area for further investigation, because it could be hypothesised at this point students who have the characteristics of cluster three are potentially an 'at risk' group in terms of academic progression. They adopt surface approaches to study and expect learning to be quick and the innate ability score would suggest they do not see themselves as being malleable as learners and believe ability is inbuilt. This in turn could indicate they are less likely to persist at learning, or in other words, are more likely to give up if they are faced with difficult learning challenges.

4.17 Comparisons of Student Groups

This series of comparisons of different subgroups of students was based on exploring the relationships of the demographic variables to the rEBI and ASSIST instrument scores using the whole dataset, not the cluster groups as previously described.

4.17.1 Age, Previous Occupation and Total Scores

Non-parametric ANOVAs indicated no significant relationships between age, educational background, previous occupation and total rEBI and ASSIST scores. In a further analysis the five age categories from the demographic item were collapsed into two new categories, under 25 years and over 25 years of age. This resulted in no significant differences being apparent on any instrument subscale score.

These findings are consistent with Chan and Elliott (2002), Weinstock and Cronin (2003) and Yilmaz and Kaya (2010) who found scores on measures of epistemological beliefs were not significantly related to age. Age was not a factor considered in the analyses of approaches to studying by Snelgrove (2004) or Mansouri *et al* (2006), although it had previously been found to have a very specific effect on factor loadings and structures on the subscales related to comprehension and meaning in the Approaches to Studying Inventory, precursor to the ASSIST (Richardson 1995).

4.17.2 Educational Background and Subscale Scores

When educational backgrounds were compared, students holding degrees (10%) were less likely to believe in the simplicity of knowledge compared to those with NVQ (26%) or BTEC (11%) qualifications, and less likely to believe in omniscient authority than those with A/AS levels (25%), all of whom represented the majority (72%) of students. The differences between students holding degrees and those holding other access qualifications could be expected given the different emphasis of their qualifications, but indicates this is an area for further investigation. A focus could be in relation to outcome measures such as attainment and attrition, because,

although an effect size of $r = .4$ is regarded as a medium effect, it reaches the benchmark effect level for educational research (Hattie 2003).

The survey did not take into account that the picture of qualifications was complicated by those holding multiple awards, such as both NVQ and access. From experience, it is known that some students use access to nursing courses as a structured route into a programme having completed NVQ level two, which may not be in a health and social care subject. Also, those who held degrees and NVQ qualifications raise questions about graduate entry which is currently an under-represented route into nurse education programmes.

4.17.3 CFP and Branch Subscale Scores

Kruskal-Wallis tests with Mann-Whitney post-hoc follow-up tests where appropriate were used to explore whether there were differences between groups of students on the basis of cohort and membership of CFP or branch (see table 4.16). A Bonferroni correction was applied to adjust the level of significance from .05 to .0167 when Kruskal-Wallis tests were followed by Mann-Whitney tests for the comparisons of educational background and the rEBI subscales (Field 2005).

Table 4.16: Results of comparisons of student groups based on membership of CFP or branch and educational background on selected subscale scores.

Comparison	Factor	Median score	Result (<i>U</i>)	<i>N</i>	<i>z</i>	<i>p</i>	<i>r</i>
CFP/ Branch	Strategic	3.79 3.53	2716.5	173	-2.43	.015	-.19
CFP/ Branch	IA	2.67 3.0	3448	193	-2.43	.015	-.18
A/AS level/ degree	OA	2.94 2.22	201.5	64	-2.85	.004	-.36
BTEC/ degree	SK	3.83 2.67	74	36	-2.75	.005	-.46
NVQ/ degree	SK	3.40 3.0	206.5	64	-2.77	.006	-.34

There were significant differences between students when comparisons were made between educational background, membership of CFP/Branch, the IA, OA and SK subscale scores of the rEBI and the strategic subscale of the ASSIST (Table 4.15) associated with small to medium effect sizes (Hattie 2003) calculated using $r = z/\sqrt{N}$ (Rosenthal 1991). The CFP and Branch student differences indicated decrease in the tendency to a strategic approach and an increase in the beliefs in innate ability, although the effect sizes were small with $r < 0.2$. Parametric test results indicated the same group differences.

When students in CFP were compared with those in Branch, the innate ability and strategic approach subscales were found to be significantly different, but the effect sizes were small.

- The median strategic subscale score in CFP was 3.8 ($M = 3.65$, $n = 109$, $SD = .56$), compared to Branch, $Mdn = 3.5$ ($M = 3.4$, $n = 64$, $SD = .68$), which was a small but significant decrease.
- The innate ability subscale scores were significantly different, but the median Branch score ($n = 72$, $Mdn = 3.0$, $M = 3.0$, $SD = .70$) was higher than CFP (CFP; $n = 121$, $Mdn = 2.7$, $M = 2.8$, $SD = 0.78$).

4.17.4 Discussion of CFP and Branch Differences

It should be remembered these were not scores that indicated any form of change in the students, but rather, reflected differences that existed in this particular cross-sectional sample. Also, the sample sizes for each of the three years were unequal so this result should be regarded with caution despite the use of non-parametric procedures.

The slight decrease in strategic approach could be interpreted as a result of the changing assessment demands of the course, which become progressively harder, and an increased focus on escalating levels of study in years two and three. This could potentially encourage deeper study approaches and engagement with material and assessments. By contrast, the apparent increase in the innate ability subscale scores

was counter-intuitive and could be interpreted as either a statistical artefact or an indication of students modifying their beliefs. This could be in the light of changes in how they saw their ability to change as learners and persist at a problem as they moved from CFP to branch as a result of feedback about assessments and coursework.

In other words, one explanation for this apparently counter-intuitive finding is as the course intensified, some students may have compared themselves to others in terms of performance and regarded themselves as less capable than they actually were. One observation to reinforce this hypothesis is a large number of the branch students were in the initial semesters of year two and had sat an end of year examination at the end of CFP. These findings are interesting as it is known that student nurses find the transition from year one to branch a difficult and stressful one (Gray & Smith 1999). Furthermore, these results suggest there is potential for a focused intervention to support students with regard to perception of their ability as learners during this period of change. One area for consideration would be an intervention to examine the potential for increased formative assessment, which can be used to encourage growth and well-being of learners and counter the potentially negative effects of summative assessment grading (Black & William 2009). With regard to the innate ability subscale, the results suggest a potential area for future research, despite the limitations of the cross-sectional sampling strategy in this study.

4.17.5 Study Approach and Belief Subscale Scores

The dominant study approach score provided a means to partition the overall dataset. Scores indicated student tendency towards a particular approach and the belief subscales were analysed using this study approach score as a categorical variable.

The median subscale scores of students in each overall study approach group (deep, strategic and surface reported in section 4.12) were significantly different ($p < .001$) when analysed using non-parametric ANOVA. Follow-up Mann-Whitney tests confirmed this, but with one exception being the surface subscale scores for the students indicating an overall deep or strategic approach, which were not significantly different ($p = .67$). The only significantly different rEBI score was on the innate

ability subscale between students indicating deep ($Mdn = 2.8$) and surface ($Mdn = 3.2$) approaches, $U = 668.5$, $p = .13$, $r = -.25$.

4.17.6 ASSIST Student Assessment of Progress

Differences between clusters and dominant study approach were explored in relation to this item self-rating performance:

- There was a significant difference between cluster one ($Mdn = 6.0$) and cluster two ($Mdn = 5.0$) $U = 962.5$, $p = .004$, $r = -.26$ in self-rating progress. There were no differences between clusters one and three ($Mdn = 6.0$) or between two and three.
- The difference between students according to study approach did not reach statistical significance (deep $Mdn = 5.0$ and strategic $Mdn = 6.0$, $p = .045$, strategic and surface $p = .03$). There was no difference between students who indicated deep and surface approaches $p = .49$.

In other words, this indicates cluster membership had a bearing on how the students perceived their progress. It is not possible to say with any certainty whether this could be interpreted as cluster three students were being overconfident in their self-assessment of progress as there is no measure of academic achievement for each individual in the dataset. However, it does raise an interesting question about student self-assessment of performance in relation to their study approach and epistemological beliefs which could be explored in further research.

4.17.7 Discussion of Findings

The results from the cluster analysis were of interest because they demonstrated that there were different groups of student with different personal epistemologies and approaches to studying. These clusters were consistent with findings in the literature, such as Bråten and Olaussen (2005) in relation to student motivation and epistemological beliefs. Straightforward comparisons are not possible with Bråten and

Olaussen's (2005) results because they used only a selection of items from the EQ in the form of two subscales 'beliefs about the speed of knowledge acquisition' (nine items) and 'beliefs about knowledge construction and modification' (seven items). However, if this limitation is acknowledged and it is accepted their two scales are roughly equivalent in terms of the underlying factors to the QL/SK/CK and IA/OA subscales, then the results can be seen to be similar. More positively motivated students reported less naïve beliefs that could be interpreted as meaning they were more likely to believe learning required effort and was gradual and to regard knowledge as evolving and actively constructed.

Three clusters are a theme in the findings on different aspects of motivation and learning styles (Valle *et al* 2003, Mason & Boscolo 2004, Buehl & Alexander 2005). The cluster analysis enabled coding of the participants so mean subscale scores could be calculated. Table 4.14 illustrates the complexity of these relationships and that the clusters were not clearly defined with overlaps between the groups in terms of their scores. The scores that clearly defined the three clusters were the EBI innate ability subscale and the total scores on the ASSIST. When the groups were examined at subscale level, there were clear similarities as well as differences for the ASSIST subscales. The same point can be made about the EBI total score which differentiated cluster one from two and three, and yet the subscale analysis showed a different picture.

Analysis of the dataset when partitioned by the dominant study approach derived from ASSIST did not result in the more detailed picture of variations in beliefs obtained by the cluster analysis. However, the proportion of students in each of the clusters in this study almost exactly mirrored finding in Leung *et al* (2008) in their study of the study approaches of mental health student nurses in Hong Kong. Their analysis showed 18% of students indicated a surface approach to studying, 55% strategic and 27% deep, based on data from 113 degree students. In addition, Leung *et al* (2008) found a general decrease in deep approach and an increase in surface approach scores, which parallels findings in relation to student scores on innate ability and strategic approach scores in this study.

4.18 Regression Model

Relationships between the key variables were explored by constructing a regression model to graphically demonstrate relationships between variables (figure 4.10) calculated using structural equation modelling (Babbie 2010). The model was constructed by entering the individual belief variables as predictors into stepwise multiple regressions with the study approaches as dependent variables. This enabled checking of diagnostics before the complete SEM model was calculated using AMOS.

The chi square for the model was $\chi^2(4, N = 197) = 7.75, p = .10, \chi^2 / df = 1.9$ which indicated reasonable fit. Additional fit indices supported this: RMSEA = 0.069 (90% confidence interval 0.00; 0.14), $pclose = .268$, CFI = .98, SRMR = .028. Effect sizes were calculated using Cohen's $f^2 = \frac{R^2}{1 - R^2}$ (Cohen 1988).

The variance explained by the model was low, with $R^2 = .04$ for deep ($f^2 = .04$), .08 for strategic ($f^2 = .087$) and .17 ($f^2 = .21$) for surface approaches. Effect sizes of .02, .15 and .35 are regarded as small, medium or large respectively.

The main inferences that can be drawn from this model are:

- Epistemological beliefs appear to have a significant, albeit small effect on approaches to studying.
- More specifically, students indicating less sophisticated beliefs about the simplicity of knowledge and in innate ability tend to adopt a surface approach to studying – that is, higher SK and IA scores predict a surface approach.
- Innate ability was negatively associated with a deep approach, and quick learning had a very small negative effect in relation to the deep approach.
- Whilst the paths from quick learning are not statistically significant, there is a positive relationship to the surface approach.
- Students who indicated higher scores on omniscient authority tended to adopt deep or strategic approaches to studying.

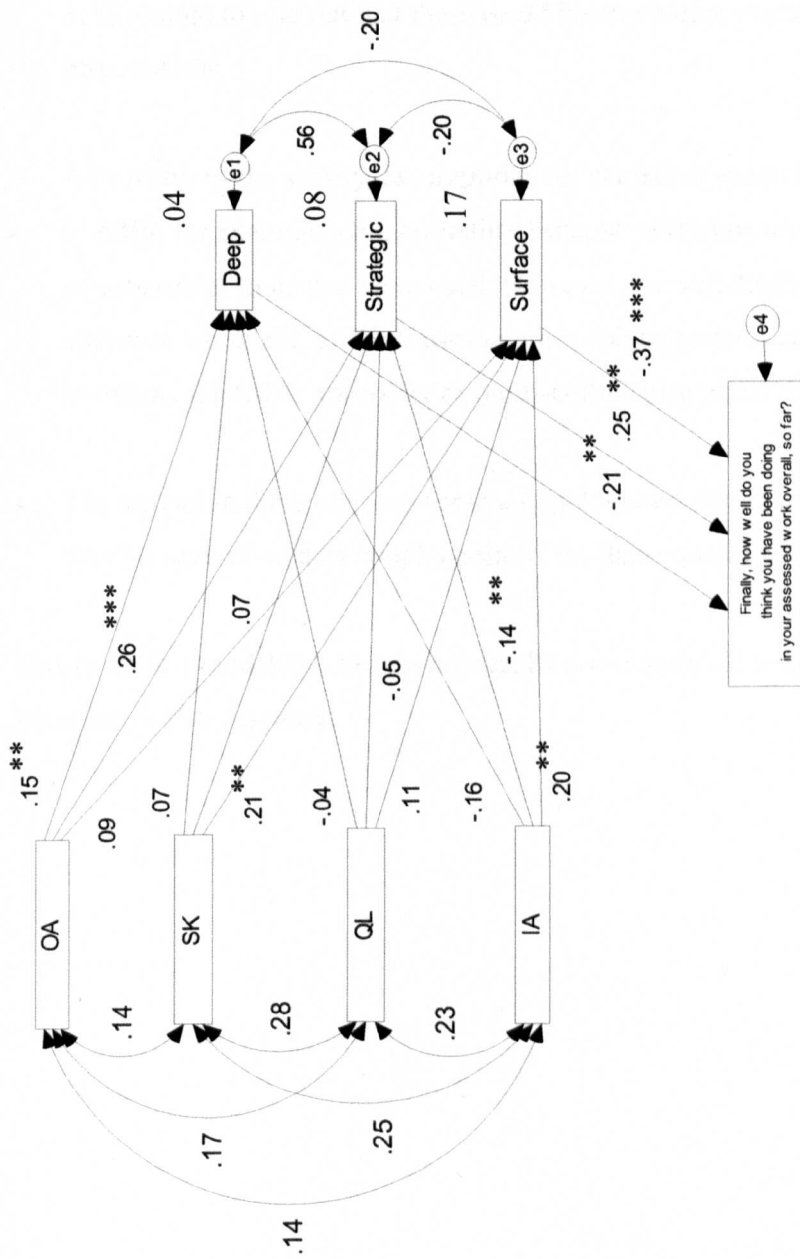


Figure 4.10: Regression path model with standardised estimates demonstrating interrelationships and influences between epistemological beliefs approaches to study and student self assessment of progress.

Key: *** $p < .001$; ** $p < .01$; e1-4 are unobserved error terms.

This model gives a concise theoretical view of complex real world processes that can assist understanding of personal epistemology and study approaches. However, the limitations specific to this stage of the analysis should be noted at this point:

- This model was constructed using non-experimental data from a survey, so it was not possible to rule out that there could be alternative explanations for the observations.**
- As a result of the survey, assumptions for statistical analyses were more difficult to fulfil, for example, data normality because of the constructs of interest and the measurement tools that were used. However, the structural equation modelling approach using ML or WLS estimation is robust and can compensate for any problems related to normality or multi-collinearity in the data.**
- The arrows in the model represent a hypothesised direction of causality and there may be several models which could fit the data equally well (Blunch 2008).**

However, this model and the survey results serve as an aid to understanding and as a basis for further research.

4.19 Limitations of the Survey

4.19.1 Self-Report Instruments

A major limitation of the survey was that the data were from self-report Likert scales completed by students from a single institution. Therefore, they should not be unquestioningly accepted as accurate representations or measurements of what respondents were actually thinking at the time they completed the questionnaire (Goddard & Villanova 2006). As pointed out by Richardson (2004), the content validity of instruments which originated in the 1970s will reflect a particular social and cultural context and the wide variation in today's student backgrounds, as supported in this research, casts doubt on just how relevant they may perceive some items to be. However, if these limitations are accepted, this criticism can be countered by the strengths of surveys, which enables rapid data collection from a number of individuals thus making the conclusion from the analysis generalisable.

4.19.2 Reliability

A further limitation concerning reliability was indicated by the overall Cronbach's alpha of 0.73 for the rEBI, which is at the lower end of what is accepted for scale reliability. However, it met the threshold value of 0.7 (Tabachnick & Fidell 2007) and, as previously mentioned, values around or below 0.7 can be expected for a questionnaire of this nature in studying abstract psychological constructs and particularly one under development (Kline 2000). Furthermore, one subscale focusing on beliefs about the certainty of knowledge, which is a key part of the Schommer (1990) model, loaded poorly in the factor analysis and this raised issues about the multi-dimensionality of personal epistemological beliefs. Low subscale reliabilities are not unusual in instruments focusing on cognitive issues, for example in a Norwegian study using the California Critical Thinking Dispositions Inventory (Wangensteen *et al* 2010) the overall alpha was 0.83, but three out of the seven subscale alphas ranged 0.46-0.52. This was regarded to be a consequence of cultural differences which reinforces the observation made in this study.

4.19.3 Cultural Differences

One further issue related to validity and reliability is that it is not inconceivable that there are educational and cultural differences between the students in this sample and those in the original validation study (Schraw *et al* 2002). The students in the original sample were mainly second and third years taking an educational psychology class in a Midwestern university in the United States. By the nature of the discipline of study, it is not unreasonable to expect that the psychology students would be familiar with inventories, Likert scales and self-report instruments. Although the student nurses in this study would be familiar with Likert scale questionnaires for course evaluation purposes, the rEBI is a more abstract instrument and asks questions about less concrete issues. One means to further develop the rEBI to increase the robustness of the items for use with student nurses could be the use of cognitive interviewing with a small sample to improve the wording and sensitivity of the questions and ensure all the desired dimensions of the construct under study are included (Collins 2003).

4.19.4 Demographic Items

The demographic items of the survey were an area for further improvement and inclusion of an item about caring responsibilities could provide enhanced information about influences on studying. The item concerning age could be modified to include the respondents' actual age, rather than a category, but both of these modifications could be problematic. They would add to the length of the questionnaire and raise questions around how much difference they would make to the analysis and conclusions, that is, they could be unlikely to make a great difference and could be considered intrusive.

4.19.5 Sample Size

Finally, the sample size of 197 respondents might be regarded as low for entry into factor analysis if custom and practice recommendations such as ten participants per item were used to calculate how many participants were needed. However, the sample was within the recommended range using the Mundfrom *et al* (2005) criteria which

indicated 140 – 300 participants were needed for a five factor solution with wide communalities. The response rate of 63% should be borne in mind because that indicates a considerable number of students did not participate in the survey.

The sample did not include students who were temporarily on leave from study awaiting re-entry to the course (which was the sampling strategy agreed in the ethics committee permission), so it could be argued the sample was not truly representative of all student nurse currently enrolled or recently enrolled with the school at the time of the study. Students who had discontinued their course were a further group of interest not included in the study, but to study them would require a different approach to the one used here because of the wide variety of reasons for non-completion of the nursing studies programme.

However, these limitations have to be weighed against the practical difficulties of sampling groups of students who attend university at various time intervals in the year interspersed with clinical placements. Techniques to overcome this could include sampling at the exit point of the year of study, but an approach now commonplace, the web-based survey, would be the sampling and data-collection method of choice if this survey approach was used again. At the time of data collection, the infrastructure components required in terms of survey software, virtual learning environments and the culture of electronic communication within the school were not well established or not mature enough to use.

4.20 Chapter Summary

The results of the survey will be discussed in greater depth in the synthesis of findings chapter six in relation to the findings from the grounded theory. To summarise prior to the integrated analysis, there were several key findings which contributed to answering the research questions:

- The personal epistemologies of students in the sample could be reliably described in terms of the rEBI data. The instrument can discriminate between student nurses with less developed epistemological beliefs from those with more developed beliefs about knowledge.
- The results from the ASSIST inventory also indicated the instrument was reliable and could be used to describe the approaches to studying of this group of students. This sample of student nurses had approaches to studying relatively consistent with findings from other studies reported in the literature, including non-health care disciplines. The inventory indicated tendencies towards the three main study approaches.
- Relationships could be demonstrated between approaches to studying and personal epistemology as measured by the ASSIST and the rEBI. This was the key finding in this study and one which deserves further investigation in future, with particular regard to beliefs about innate ability and beliefs about the source and structure of knowledge.
- Within this sample there were sub-communities of students who indicated similar, yet subtly and significantly different personal epistemologies. In particular, the sub-communities could be distinguished on the basis of the beliefs related to the innate ability factor. Those who indicated the ability to learn is acquired through experience and persistence and was not a fixed trait tended to adopt deep and strategic approaches to studying.

- Students in the cluster who indicated beliefs in knowledge were less likely to be certain or simple and was less likely to be learned quickly or handed down by an authority indicated a higher tendency to adopting deep and strategic approaches to studying.
- When students indicated they had more naïve epistemological beliefs than those in other sub-communities, they had a higher tendency towards adopting surface approaches to studying.
- With regard to the student demographics, age and previous occupation had no discernable statistical effect on student nurse personal epistemologies or approaches to studying. However, the educational background of the students was associated with a significant but specific effect in relation to the difference between those holding degrees and students who held a BTEC qualification. Students who held degrees were less likely to indicate beliefs in the simplicity of knowledge, which could reasonably be expected from completion of this level of academic award and training. Furthermore, they were less likely to believe in knowledge transmission by an authority figure, that is, they were more likely to seek out and construct knowledge for themselves. There may be a relationship between previous occupation and educational background which was not demonstrated in this study.
- There was a significant difference between CFP and Branch students in this sample in relation to adopting a tendency to a strategic approach and their ability to change as learners. Students in branch were less strategically oriented, interpreted as a reflection of the changing demands of the course and higher levels of study coupled with academic success and assignment feedback.
- A difference in the indicated beliefs about innate ability between students in CFP and branch was apparent with branch students indicating slightly more naïve beliefs. This result was contrary to what was intuitively expected and again, this may be a result of the demands of higher levels of study and could be interpreted as a revision of one's ability to adapt to those demands. This conclusion suggests this is an area for further study.

4.21 Conclusion

The results from the survey have demonstrated diversity in the student sample profile in relation to demographic variables which would support an assertion that the sample was not homogenous. The students came from a wide range of backgrounds, with different educational and academic qualifications and there was a marked variation in age.

Student nurse personal epistemological beliefs and approaches to studying can be described in terms of numerical variables for the overall sample, but what was more informative were the characteristics of the sub-communities of students and how they varied. Statistical analyses of the questionnaires used in this survey demonstrated both significant and meaningful differences and relationships in student approaches to studying and their personal epistemologies. These relationships will be explored in greater depth in the following chapter in conjunction with relevant elements of the grounded theory study.

The study has raised questions concerning the number of factors the rEBI can discriminate which contributes to the ongoing debate about the multi-dimensionality of personal epistemological beliefs. The results suggest the rEBI can distinguish key factors, but those related to the structure of knowledge may be more fine-grained, and therefore more difficult to explore using this questionnaire. However, this twenty-three item instrument can quickly provide data about personal epistemological beliefs if these limitations are accepted.

Finally, the survey raised a number of questions which indicate areas for further study, particularly in relation to changes in epistemological beliefs about the ability to acquire knowledge.

Chapter Five

A Constructivist Grounded Theory of Relationships between Student Nurse Personal Epistemologies and their Approaches to Studying

5.1 Introduction

The grounded theory constructed between the researcher and participants is presented in this chapter. The mixed methods approach was used to provide more knowledge than separate analyses. The grounded theory was intended to contextualise the survey results in the social world of the students and to give an explanation of influences on studying and the effects of epistemological beliefs. The aim of the chapter is to demonstrate how the raw interview data were translated into a grounded theory of student nurse personal epistemologies and approaches to learning. This is achieved through description and explanation of the key properties of the conceptual categories that build the theory. To promote understanding of the student experience, active codes and categories are used to impart a sense of process. The theory is meant to be interpretive, with the emphasis firmly on understanding rather than causation and at this point, it is acknowledged this substantive theory is situated in a particular time, place and culture. This had an effect on the resulting theory, which is not discovered as in classical grounded theory, but is dependent on the researcher's views and values (Charmaz 2006a).

Key areas that emerged during the interviews were how participants integrated approaches to studying into their social lives and how they articulated their constructions of personal epistemologies. These addressed the research questions because approaches to study were socially constructed and, in turn, influenced by epistemological beliefs, in particular, beliefs in quick learning, innate ability and omniscient authority. The main findings centred on how the participants experienced their nurse education in the academic institution and how it was influenced by the

surrounding social structures in the form of their families, friends and colleagues in their cohorts, coupled with their experiences in clinical practice placements.

Example elements from the processes of coding, extracts from memos and how they influenced theory construction are included to demonstrate how the final theory was grounded in data. In these findings, all names or any other identifying information that have been changed or removed are indicated by text in square brackets.

5.2 Sample details

The sample for the main series of interviews included ten student nurses who ages ranged from twenty years old to forty three, although most were in their early twenties to late thirties. The age profile roughly approximated the profile of the survey sample. Thirty-seven students initially volunteered and provided consent to be approached for inclusion in the study and ten were recruited after being contacted to make the firmer commitment of a time and date for the interview. The sample was therefore recruited opportunistically based on the pragmatic criterion of being available for interview, rather than any driven by any requirement for theoretical sampling. Specific details about each participant's age are not reported here as it did not appear to be a factor that influenced participant approaches to studying or epistemologies during the interviews and analysis, which corresponded with the survey findings.

The interviews took place in an office in the school building. Nine of the students were female, three students were in CFP and the remainder were from adult branch. Seven of the student participants talked about their childcare responsibilities and two of the remaining three had a varying degree of caring responsibilities for other family members. The remaining student did not have immediate caring responsibilities, but was a long distance from home and family. All the students had worked in various roles including paid care work, but also in administrative, sales and engineering posts. Two students reported that they had studied in higher education institutions to degree level prior to the course and several compared their experiences with university students they knew who were studying different disciplines. This demographic information is included to be supplemental to the theoretical sampling which was lead

by emerging categories as the interviews progressed over the course of a six week period in 2010.

Most of the interviews were of 30 -35 minutes duration and ranged from one short interview of fifteen minutes to one which was slightly longer lasting 43 minutes. This was actual recording time and informal conversations with participants usually took place before and after the recorded interview. The conversations enabled the participant to settle in for the interview, and a variety of topics arose during this time. They were often connected with clinical practice placements or previous academic experiences in other institutions, some of which are noted on the transcripts in the appendices. The content of these conversation notes did not necessarily enter into the analysis, but the conversations did have an effect on the context of the interview and influenced my subsequent thoughts about interpretation of what the participants were saying. These notes about a pre-interview discussion seemingly set the context for the start of this interview, for example:

We talked for a while before the recorder was on about issues arising from placement around an incident involving debatably poor care of a patient with a sensory disability and the apparent refusal by a member of untrained staff to deliver fundamental hygiene care. We discussed attitudes to male staff and talked about dealing with 'problem' members of the team who were 'spotted' from the start of the placement.

This student gave quite workmanlike or brusque answers when the interview commenced, but as probes were inserted, this initial front broke down a little and more considered responses were made.

(participant 2)

The student may have felt they needed to report this episode of care, but alternately it could possibly be interpreted in this instance as an attempt to level the playing field between us, possibly as student and lecturer, or researcher and interviewee. This student had a clear opinion about what was right and wrong in terms of the issues arising from an episode of patient care. Talking about student learning was appeared to be acceptable to this student, but nursing care was understandably more important and the focus of the course for them.

Another participant continued to talk after the interview had ended:

Talked for brief time after recorder switched off; this interviewee expressed surprise at not being the oldest student on the course and appeared to draw a lot of support from friends and colleagues in the cohort in terms of both practical help with the course and friendships in the classroom and clinical practice. Emphasis was added to this aspect through contrasting [their] experiences during the [previous] degree. This was undertaken when she was younger and she stated some of the individuals on that course were very different from her, which implied that she had more in common with others in her cohort now.

The interview took place about mid-morning and this student appeared to be comfortable talking about her experiences; she paused often and appeared to consider her answers to some of the questions.

(participant 5)

This student was very forthright and provided quite frank answers to questions. Also, they were the first to be interviewed and provided a firm starting point for the analysis.

Notes served as reminders about the context of interview and were useful in developing theoretical sensitivity. They were also useful when the completed transcripts were checked against recordings as an aid to place the interview in a social context.

5.3 Development of Core Codes and Categories

5.3.1 Coding

Initial coding was undertaken quickly and impressionistically whilst reading the transcripts of interviews or listening to the recordings (Charmaz 2006a). This approach facilitated development of a preliminary and spontaneous set of codes and coding framework. Some codes were superficial and descriptive at first, but became more conceptual with the use of gerunds during coding, and as interviewing progressed and as the material became more familiar.

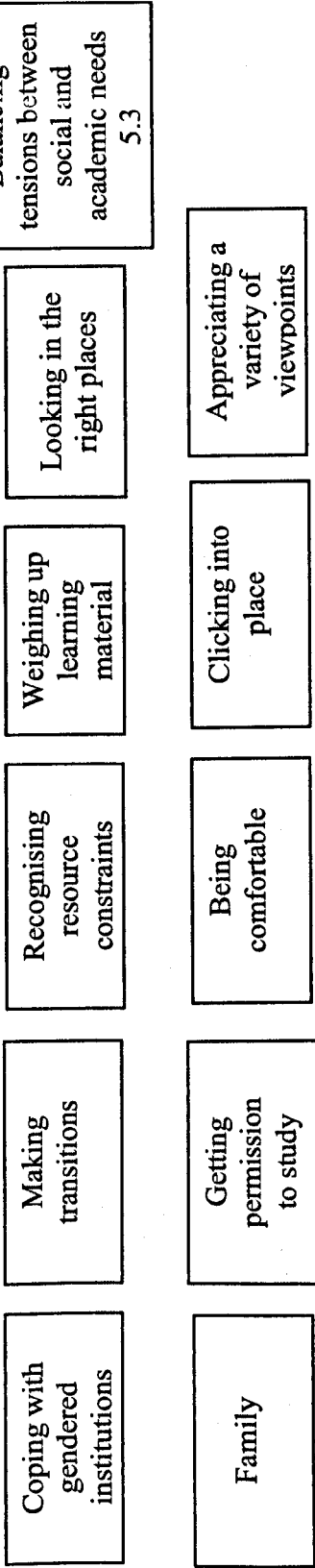
This quick initial coding resulted in some quite static or thematic codes as in figure 5.1, such as family or tension, but these were re-worked and developed as more detailed and theoretical codes developed. In this diagram, codes are at the foundation (base of diagram) and the theory develops and becomes more abstract and conceptual as the diagram is read vertically. Later diagrams in this analysis illustrate how codes are associated with categories and how certain categories are inter-related. Some codes and categories are more important than others, and some codes are associated with more than one category.

There was no break or separation between the initial coding and later forms of coding, categorisation and analysis as the process became continuous and iterative with each round of coding building on the last to achieve saturation. This could be visualised as a helical or recursive process, rather than being a step-by-step procedure, which is recognised as being sympathetic to emergence of theory from the data and the aim of the constructivist process (Chen & Boore 2009).

Substantive Theory

Conceptual categories

Categories



Codes (examples)

Juggling Transitioning Innate ability Omniscient authority Simple/certain knowledge Collecting information
 Quick learning Family Caring role Mechanic support role Tension Allowing time
Read, read, read Clicking Using different sources of information Appraisal of academic
 ability Using too much material *It's not the content it's the volume* Stress of being stuck Being affected by children

Figure 5.1: Development of preliminary codes and categories as grounded theory units of analysis (in vivo codes in italics).

5.3.2 Memos

Memos were written at all stages of the analysis process beginning with the first interview and the resulting transcript and memoing continued whilst writing the draft analysis. This chapter was developed from memos and conceptual diagrams, some of which evolved from free writing and reflective thinking about the interviews. This example is from a memo about transitions:

Sometimes there was a clear point that stuck in the memory, such as an unexpected assessment mark that prompted a rethink about the approach taken to the assignment and to the course. Sometimes it was a dawning recognition of change.

(25th March 2010)

Memos such as this one built around the categories of the family and time to study helped to move from descriptive codes to more abstract conceptual categories, here being the cost of studying described in subjective terms:

...It was a source of both tension and also relief, for all. Family time and study time had to be carefully balanced and that tension was always there, although it could submerge during the immersion of studying, however, that immersion could cause time to change and pass increasingly rapidly. There was almost a recognition that the time was taken illicitly, although it was a gift, it could be almost a guilty indulgence. Also, that the time was granted, but really, it was given almost grudgingly.

(9th April 2010)

Memo writing in this way enabled creative exploration and development of ideas with few restraints, which again encouraged emergence of a conceptual framework. The next sections of this chapter will present those ideas with supporting codes and categories.

5.4 Presentation of the Grounded Theory Categories

The grounded theory categories are presented in this chapter as follows:

- Juggling studying and family needs;
- Making sense of knowledge;
- Evolution as a knower;
- Adopting an individual learning strategy.

These comprise the core and main categories of the theory and they are presented with associated sub-categories and supporting transcript excerpts to provide evidence for their grounding and derivation. Where diagrams are used to depict relationships between the categories, numbering of the categories relates to the chapter section in which they are presented. The final diagram at the end of the chapter (figure 5.5) includes all the previous sub-diagrams with numbered categories as an indicator of how the theory was constructed.

Juggling studying and family needs (section 5.5) considers how students and their families interact to negotiate time and resources for study with particular focus on the emotional effects of the process and the subtle transactions that occur. At the same time, students are negotiating relationships with knowledge (section 5.6) and a process of how knowledge is gained is outlined with regard to the role of the teacher. As the student undergoes the experiences of studying and learning, there is a process of evolution as they begin to become increasingly self-aware as knowers and they also become aware that this is happening (section 5.7). Adopting an individual learning strategy (section 5.8) is a consequence of the former processes and is the overall outcome. Throughout the processes, students have to cope with multiple gendered institutions which are socially constructed contexts in which they live and their learning takes place. This is not included as a category, but appeared to be an underlying theme in the interviews. Finally, the tacit influence of epistemological beliefs as a higher order theme is considered throughout these stages with reference to how they were articulated by students.

5.5 Juggling Studying and Family Needs

This became the core category and incorporated almost solely the material developed from memos and the categories derived from codes connected to family relationships (table 5.1). The influence and importance of family relationships and the social cost of studying were universally reported or alluded to by all participants, regardless of age and gender, thus the magnitude of the effect of this cost on students cannot be overstated. It was the category that formed the core of the grounded theory because the influence of this category pervaded all others and, arguably, this category made the theory family-centred rather than solely focused on the student. It could be argued by educationalists that there was nothing new or unknown here (Johnson & Robson 1999, Kevern & Webb 2004), but the family as a concept is highly variable and one which we all experience in different ways. Examining it afresh from the perspective of approaches to studying and personal epistemology offered new insight into the experience of this group of students.

The family were represented in various ways, even if they were absent or family at a distance. Roles and responsibilities in the family were diverse and wide ranging, and family could be present in the form of parents, partners, spouses, children, brothers and sisters, or there could be family responsibilities involving grandparents or helping other family members with children or caring responsibilities:

Family influences obviously, being a more mature student, that is a big influence on me, influences on time and having the resources to be able to study, say for example quiet, no kids around, that to me is my biggest influence on it.

(2: 3 - 6)

Right, I get a lot of support, I am lucky in that way, my mum will help with babysitting and _ is very good like that and will...fix the computer and you know, if I'm panicking over stuff or the printer, so I have, I definitely have a lot of help...I do really, really want to finish my degree and make everyone proud and all the rest of it, so yeah, it's a big influence.

(5: 86 - 90)

Example coding units	Example codes	Category	Core category
Right, I get a lot of support, I am lucky in that way, my mum will help with babysitting and ___ is very good like that and will...fix the computer and you know, if I'm panicking over stuff or the printer, so I have, I definitely have a lot of help, um..I do really, really want to finish my degree and make everyone proud and all the rest of it, so yeah, it's a big influence. (5: 86 - 90)	Family		
...perhaps ___ probably thinks I should be able to get it done quicker, you know, than, ___ doesn't understand the concept of how much time I should be putting into it, and um ___ definitely, she knows when I've got an assignment and she's like, hurry up and get it handed in mummy, she knows I'm naggy and stuff when I'm doing it, so I 'spose it all affects it, it's like a big sigh of relief when it's handed in... (5: 94 - 99)	Caring role		
Family influences obviously, being a more mature student, that is a big influence on me, influences on time and having the resources to be able to study, say for example quiet, no kids around, that to me is my biggest influence on it. (2: 3 - 6)	Offering mechanic support		
I do everything to make my family happy, that is why I'm doing nursing. (1: 8 - 9)	Allowing time		
I find it very hard to do my learning because I have got a lot on, I have a house, a daughter and working as well... (4: 10 - 11)	Producing tension		
(...when you mentioned time - what are main constraints on your time?) For me, family, ___ dogs, ___ works away quite a lot and it takes me half an hour to get home and I just need time to switch off and not think about it for awhile, so I put things off for a little while. (3: 65 - 67)	Giving time	Family	Juggling studying and family needs
Sometimes I just feel my heads full up you know, the other night I was trying to revise my conversions and she was copying me, and I thought leave me alone now, and I'm thinking 'oh God', I just feel torn, you know what I mean, because it's, like I said before, it's all a balancing act, it's juggling my time... (6: 201-202)	Feeling guilt		
Cos I'm not spending time with my partner, huh, instead I'm reading and doing my essays (But you said ___ is supportive of you..) Yeah, [partner] does say, you know, go and do it, go and do it, but then [they]'ll watch telly and you'll see [they] go over and look at you, and then carry on and watch telly again and.. ahh... (7: 2:28)	Gaining partner support		
	Being affected by children		
	<i>Make everyone proud</i>		
	<i>Big sigh of relief</i>		

Table 5.1: Example coding units, codes and categories that informed the element 'Juggling studying and family needs'.

In vivo codes in italics, participant identifier in brackets with line numbers or time code.

My family comes first, yes, if I have not got any studying done that day then it is hard luck, I have to find another day to do it. (4: 23 – 24)

I also have a lot of support at home and if there is something I am struggling on he will say to me look you know you can do it you are a bit stressed at the moment and try again later - something good like that. (4: 66 – 68)

The family were understandably one of the most important influences on student studying, but that influence took many forms that could be a cause of tension and pressure, yet also provide a great source of material, psychological and spiritual support and comfort. However, it became apparent that support from the family was not unconditional and some students indicated it came at a cost, such as the effects of roles and other family members' achievements as reported below, which was expressed explicitly, whilst others tacitly acknowledged it as an effect and a transaction beneath the surface. Family pressures and tensions were not reported or stated as being perceived purely in negative or positive terms – there was a tone of acceptance, these pressures were there for the students as they are for all of us and were just something that had to be lived with and worked around.

Often, the family were involved in a collective effort to provide support for the student, although it was tacitly suggested that they wanted the attention of the student during the time spent on studying (explored below). This attention-seeking aspect could be countered in favour of the student by role models in the family, some of whom had achieved their higher education awards whilst bringing up young families. This resonated strongly with the experiences of those involved in delivering the course who had gained academic awards during their clinical and teaching careers. These achievements could be regarded as key drivers, as something to aim for, and to *make everyone proud* was an essential element of the drive to complete the course and achieve graduate status:

...my family are [professionals], so I feel they want me to do well, so I put more effort in to impress them really...I do everything to make my family happy, that is why I'm doing nursing.

(1: 4 - 9)

Yeah, I think my mum, 'cos she did a ___ degree when we were all kids, so more than anyone, my mum understands...

(5: 93 – 94)

I do really, really want to finish my degree and make everyone proud and all the rest of it, so yeah, it's a big influence.

(5: 89 – 90)

Exemplars of family members who had achieved their academic goals provided support, but this could also be a source of challenge, something to live up to, and could be the focus of much personal investment in terms of time and effort which may have started well before the pre-registration course during access courses or in the form of career changes. Aspirations to achieve and the desire to clear hurdles led to a realization in some that it was possible to do better, in terms of both their learning and future career, and to be able to achieve whilst not underestimating their ability to do so:

Do you know what, in the last year I have changed my mind because I always thought there are people that are more intelligent, like doctors, lawyers, but I do not think, I think it's the amount of work you put in yourself. I was speaking to [someone] that I used to work with before and he told me I should be a _____ and I laughed at him and he said no, if I can do it, you can do it and he was not very clever at some things, and I think, that he must have worked really hard to get where he wanted to get. I do think it's all about effort.

(1: 181 – 188)

This was a function of both family pressure and a need for participants to do well on their own terms.

Family, friends and, principally, partners, offered material as well as emotional support by being fixers of problems and suppliers of services that could help the production of coursework or assessments, such as remedying computer problems or taking on caring roles to free up the student to focus on their work:

I get a lot of support, I am lucky in that way, my mum will help with babysitting and _____ is very good like that and he will...he fixes the computer and you know, if I'm panicking over stuff or the printer, so I have, I definitely have a lot of help.

(5: 86 – 89)

However, there was often a tacit recognition that they did not always understand or comprehend just how much time and effort was required to produce academic work to an acceptable standard in the eyes of the student, let alone produce a 'good' piece of work:

...perhaps [he] probably thinks I should be able to get it done quicker, you know, than, __ doesn't understand the concept of how much time I should be putting into it...

(5: 94 - 95)

Furthermore, they possibly did know how much effort was required, but were reluctant to acknowledge it and to let the student spend that time on study and thus, not on the family. This reluctance or lack of understanding could be operationalised after giving the material support wanted for study in various ways. These included partners being present in the environment where the student was studying, which served as a reminder that they were still there and had needs. Reminders could take the form of a quick look at the student to catch their eye, or other activity that could be disruptive and not conducive to study. This could obviously be a distraction from study and also came across as a potential source of guilt for the student because they were ignoring or neglecting their partner:

Cos I'm not spending time with my partner, huh, instead I'm reading and doing my essays (Int: But you said __ is supportive of you..) Yeah, [partner] does say, you know, go and do it, go and do it, but then [they]'ll watch telly and you'll see [them] go over and look at you, and then carry on and watch telly again and... ahh...

(8: 2:28)

There was an unacknowledged fear of pushing the relationship too far, so again, there was a tension arising from balancing the needs of everyone in the family network.

The greatest contribution to study the family could make was that of the gift of time (time itself became the subject of a separate memo) as well as space and peace to study:

Family influences obviously, being a more mature student, that is a big influence on me, influences on time and having the resources to be able to study, say for example quiet, no kids around, that to me is my biggest influence on it.

(6: 3 - 6)

Time available was influenced by effective time management, financial concerns and needs, by juggling home, study and part-time work. This gift could be managed for effective studying and planning ahead and organisation was essential for this time to be used profitably. For some, where the family came first, that gift could be returned quickly if they felt they could not concentrate on their study because of the needs of children or partners. The build up to, and conclusion of a more intense period of study was a source of both tension and also relief for all involved when it resulted in the submission of an assignment:

...definitely, she knows when I've got an assignment and she's like, hurry up and get it handed in mummy, she knows I'm naggy and stuff when I'm doing it, so I 'spose it all affects it, it's like a big sigh of relief when it's handed in...

(5: 96 - 99)

Family time and study time had to be carefully balanced and that tension was always there, although it could submerge during studying, however, that immersion in academic effort could cause time to change quality and pass more rapidly than usual.

There was recognition that the time was taken illicitly, and although it was a gift, it could be almost be a guilty indulgence. Also, there was a perception that time was granted apparently freely, but really, it was given almost grudgingly or selfishly. Where children or a caring role was concerned, those feelings could be heightened and become a cause of concern, with that time away from the children, particularly during evenings, which evoked strong feelings:

Sometimes I just feel my heads full up you know, the other night I was trying to revise my conversions and she was copying me, and I thought leave me alone now, and I'm thinking 'oh God', I just feel torn, you know what I mean, because it's, like I said before, it's all a balancing act, it's juggling my time...

(6: 201 - 202)

That gifted time could not be recovered and returned to the children, but what helped to offset those emotions was a sense of purpose to achieve and to translate those achievements into a better quality of life for the family. From a selfish perspective, time could be granted as long as the family felt the benefits, even if those benefits were delayed or promised and would be felt in the future:

..it means if I have got a lot of work she is very understanding, knows that sometimes I cannot do the family things, she knows it is only for two years, so she understands, and they are good at giving me that extra push..

(4: 73 - 76)

An alternate interpretation could be that the offers of help were possibly a selfish strategy by family members, employed so that the student could complete their work and then pay attention to the family again more quickly. The students may have been transferring their sense of guilt onto their family members to accuse the family of putting pressure on them. In other words, the students were using the family to express their guilt that they were feeling.

Inclusion of the family in studying was an important issue because being a student indicated a change in social status and the student might not want to leave the family behind (although this might not be an undesirable effect of the role change). Students appeared to carry out many of their study activities at home, often because of caring responsibilities or social activities. The library, on the other hand, was a place for gathering information, a repository rather than a resource for study, and access to virtual library resources was a great help to many students, although accessing information could be a complex process that had to be learned before becoming competent and proficient. Studying at home had further repercussions, and it was possible that working on assignments could be used as justification or a cause to argue for the conditions required for studying.

There were few reported overtly negative effects reported that resulted from the tensions arising in the family, although family could apply pressure bordering on abuse. In one instance being laughed at by members of the family because of return to full-time study was a cause of distress and self-doubt, as well as an attack on self-worth. This insidious criticism extended its reach into assessment work and exerted an effect on the student's perceived ability to achieve. However, this was an isolated case and most effects were far less negative. Some could be translated into positives, for example the family member who was a healthcare worker who reacted to constant worry expressed by a student about an examination by telling them to just 'get on with it.' This prompted reframing of the problem by this participant and enabled them to be

successful in the assessment they were previously so concerned about. Family dynamics and the gift of time could be the cause of redirection of learning towards an assessment driven focus or strategic approach, although this could mask a desire for deeper engagement with study.

5.6 Making Sense of Knowledge

Student relationships with knowledge centred on a handful of key processes involved in studying and learning, but these all involved some form of negotiation or transaction, either with others or internally with self. Purposeful collection of information and material, principally to support assignment production, but also to satisfy curiosity and interest, was a fundamental part of this around which negotiations with self or others occurred. The conceptual category negotiating relationships with knowledge is represented in figure 5.2 with sub-categories and relationships are represented as dotted lines.

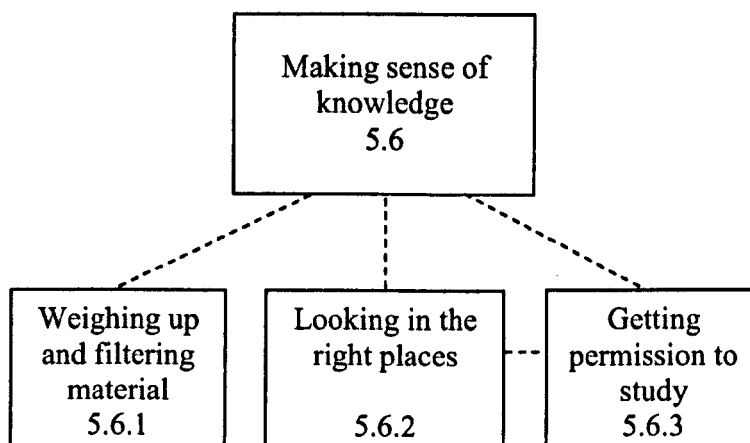


Figure 5.2: Properties contributing to negotiating relationships with knowledge.

Conceptions of studying were expressed using language which conveyed the sense that initially studying was a form of collecting. Knowledge, therefore, was a commodity that existed in collectible forms. The gathering of knowledge was usually from authoritative sources including books, journal papers, reading lists and electronic

resources, indicated by sources of authority, the teaching staff or librarians. These sources of knowledge had a hierarchy and competence at accessing, sorting and using the sources was gauged in terms of speed and time. For some participants, studying and academic learning was defined in terms of collecting and weighing up knowledge from approved sources destined for inclusion in written assessment work. As well as an indication, a more concrete permission from an authority was often needed to include or to read material regarded as potentially suitable for the assignment, or material regarded as an interesting aside, but not necessarily relevant to assessment:

...she did guide me quite a bit and __ helped me quite a bit as well. Just make sure I think I'm looking in the right places and that I'm actually reading what I'm meant to be reading.

(5: 35 - 37)

Furthermore, those authorities, principally teaching staff, but also others such as librarians, were measured and assessed on their 'directiveness' in aiding the rapid and efficient collection of information. Collecting, accumulating and reading learning material was limited by resources, the main one being time, an important component of the social cost of studying category. Finding time to study and putting the time in were not just about the passing of time on the clock, but were also about a context of study. Here, particular conditions or requirements had to be met, which included temporary suspension of relationships and commitments in addition to physically preparing an environment conducive to study. What was interesting was a lack of separation of studying from the home environment, as it became apparent that the library was primarily an information source rather than an environment for working on assessments.

Example coding units	Example codes	Category	Core category
..probably a matter of me feeling personally I've got enough information and maybe the volume of journals I find, I probably judge it on that a bit, um...so it's maybe it's not the content, it's the volume. I feel better if I've maybe got twenty rather than five really good ones, so I probably could do with sorting that out [laughs] (5: 3, 28 - 33)	<i>Looking in the right places</i>		
I think if they've got a good summary at the start, read through that quickly, I mean I am quite bad in that I don't do as much general reading as I should, I more, I focus more on assignments, so that's probably when I do the most reading, but yeah, a quick glance at the summary at the start and then I sort of just gauge whether or not it's worth looking at. (5: 2:16 - 20)	Permission to study	Getting permission to study	
I still feel I have to work harder than other people sometimes because I find it hard to understand (1: 22 - 23) it's hard to understand this very complex subject and I just switch off because I think I am never going to remember all this, I just switch off completely thinking there is no point in learning it (1: 42 - 44)	Putting the time in		
I am greedy for books, it's time again, it is hard to sit down and read them, but when I am coming to do, like the assignments, I would want all the books I can get. I have actually found I have surprised myself I actually quite enjoy doing them, but I am a slow worker, I am very, very slow, I would say quite thorough, but I really take my time and go over it and over it, I want to get it as right as I can get it, so I will use loads of books and take the time reading them. (3: 48 - 52)	Getting guidance		
she did guide me quite a bit and ___ helped me quite a bit as well. Just make sure I think I'm looking in the right places and that I'm actually reading what I'm meant to be reading. (5: 35 - 37)	Rebuilding knowledge	Looking in the right places	Making sense of knowledge
My ideas of learning, I feel that it's more my problem really, I feel I have got to train my brain, it's about retaining that information, so I know I have got to read more and put more time and effort into it I think. I think it is down to me. (3: 200 - 202)	Measuring achievement		
..in the last year I have changed my mind because I always thought there are people that are more intelligent, like doctors, lawyers but I do not think, I think it is the amount of work you put in yourself (1: 181 - 183)	Sources of knowledge	Weighing up and filtering material	
I don't know if it is complicated, maybe for me working practically, things appear a lot more complicated and difficult when it is explained and everything is given a term and a title, and when you are in practice trying to actually doing it... (3: 113 - 116)	<i>Read, read, read</i>		
	Wanting to <i>understand it all</i>		
	Using different sources of information		
	Changing aspirations		

Table 5.2: Example coding units, codes and categories that informed the core category 'Making sense of knowledge'.

In vivo codes in italics, participant identifier in brackets with line numbers or time code.

A process of studying became apparent characterised by how the gathering of learning material for study took place:

Looking in the right places – this was a naïve epistemological position in the process whereby information or material was collected having received directions from an authority. Also, electronic information could help this process, search engines in particular, although it was apparent these were not to be wholly trusted or regarded as the source of authoritative information unless validated by being recommended or cross-checked.

Getting permission – this was a category inter-related with looking in the right places. As well as measuring the quality of the directiveness of the tutor, which was a component of the permission given, there was a tacit recognition that trusting the tutor giving permission was a requirement for 'comfortable' study. As students progressed through the course, some were more confident and would only see the tutor as a last resort.

Gauge whether or not it's worth looking at – at this point, there was a subjective weighing up of the material:

I think if they've got a good summary at the start, um, read through that quickly, I mean I am quite bad in that I don't do as much general reading as I should, I more, I focus more on assignments, so that's probably when I do the most reading, but yeah, a quick glance at the summary at the start and then I sort of just gauge whether or not it's worth looking at.

(5: 16 - 20)

Knowledge could be subjectively judged and weighed to see if it was just right for reading and inclusion into assignment work. The main selection tool was the abstract, summary or introduction. No detail was provided as to how a decision was made to reject material, but there was a gauging or weighing of worth of the material to justify inclusion in the assignment. It was almost as if the decision to stop gathering information was intuitively and subjectively driven or based on common sense, rather than one that was indicated by defined indicators.

It's not the content, it's the volume (I feel better if I've maybe got twenty rather than five really good ones) - the greater volume of material, the better the feeling about it's usefulness, although this was tempered by recognition that this approach would need to be changed into a more selective one for success later in the course:

..probably a matter of me feeling personally I've got enough information and maybe the volume of journals I find, I probably judge it on that a bit, um...so it's maybe it's not the content, it's the volume. I feel better if I've maybe got twenty rather than five really good ones, so I probably could do with sorting that out...[laughs]

(5: 28 - 32)

..you're meant to read, read, read for a degree and I do probably do the bare minimum so, that's something, I'm obviously starting the third year now, I need to do, I'm more motivated now, but whether it'll stick, I don't know.

(5: 122 - 125)

Being greedy, wanting all you can get characterised the opposite pole of the mass accumulation approach of 'it's not the content, it's the volume', and was a more sophisticated conception of studying if examined beyond the superficial smash and grab approach:

I am greedy for books, it's time again, it is hard to sit down and read them, but when I am coming to do like the assignments, I would want all the books I can get. I have actually found I have surprised myself I actually quite enjoy doing them, but I am a slow worker, I am very, very slow, I would say quite thorough, but I really take my time and go over it and over it, I want to get it as right as I can get it, so I will use loads of books and take the time reading them.

(3: 48 - 52)

It was not just about quantity, but more about a need to get as much as possible to satisfy a deeper desire to study and learn for oneself, and could occur without permission and the direction that implied.

At its most basic, the overall process could be boiled down to one of collect, weigh, tag and move on to the next section or task. As with clinical practice, competence was measured by the student in terms of the speed of the performance of collecting and assessing procedures and volume collected. This ability to perform the task quickly

and efficiently was something that improved with experience and the right assistance. The more advanced conception included the expectation of collecting large amounts of material, but this was driven by hunger and a need for completeness rather than uncertainty.

The gathering process and relationship with knowledge was not just concerned with the amount of information that could be collected. Preferences were expressed for certain subjects with information structures that were straightforward to break down into constituent parts, rather than the more complex areas with problems which might have multiple and challenging fuzzy viewpoints. This was not only because of the emotional or liminal response that could be invoked, but also because it might not be constructive in terms of getting the assignment done or getting approval from the clinical practice placement. Conflicting sources, or information that was the cause of liminality might be avoided or put aside because they intuitively felt wrong. However, this could be perceived as a way to avoid the challenge inherent in studying or to personal constructions of knowledge and was possibly a route that could lead to studying the wrong information.

If there was an issue about understanding or the house of knowledge fell down, then it could be rebuilt in a more meaningful way. This was a route to making sense of knowledge. Other people or family might be employed to help because of their ability to see the obvious, something staring you in the face, amongst the morass of information:

...speaking to even my boyfriend or my mum, they're both very good at something that might be staring me in the face, and they'll look at something for me and say go back to this...I don't think I've had a problem where I'm totally stuck, I think it's more I don't get enough information...

(5: 64 - 67)

They could also help even if they were not listening by being someone you could talk your ideas through with and allow you to confirm for yourself that knowledge is sinking in, that you have changed.

There was an emotional component to studying that emerged during the different stages of the process. Potentially challenging areas of learning, such as studying ethics, were regarded as creating an uncomfortable state, which could be characterised as the liminal state encountered during troublesome learning. This state caused feelings which could include being confused, irritated, fed-up, and a loss of motivation, even to the point of provoking crying with frustration:

..I get confused with it, maybe fed up and irritated and...lose my motivation probably a bit, if there's too many, you know, choices of how I could answer.

(5: 164 - 166)

I was tearing my hair out, I was just like I cannot do it kind of thing but then eventually I sat down and read a few books on how to do assignment writing and I spoke to my assignment tutor and rewrote it and then eventually she said I had got it; it was that moment I had achieved something. I think that drives you when you know how important it is to achieve something then gives you that push to stick at it.

(4: 61 - 64)

Liminality was to be avoided if possible through studying information that made sense and was structured and accessible, particularly about traditional favourites such as body systems, anatomy and physiology:

..prefer more factual as I can understand it and take it in a lot more whereas with the other stuff I get a bit 'ooh', I feel it goes...not over my head but I find it hard to think about...but I am interested in anatomy and physiology so that is probably why, because that is an area I like.

(4: 163 - 167)

Defence mechanisms could come into play if there were difficult areas to study on the horizon, but these were regarded as counter-productive and included switching off or keeping quiet in the classroom.

Surface approaches to studying were articulated in different forms. For example:

My ideas of learning, I feel that it's more my problem really, I feel I have got to train my brain, it's about retaining that information, so I know I have got to read more and put more time and effort into it I think. I think it is down to me.

(3: 200 - 202)

...I just switch off because I think I am never going to remember all this, I just switch off completely thinking there is no point in learning it.

(1: 42 - 44)

However, these student excerpts present two qualitatively different viewpoints in relation to the surface approach. The first is a collector of information and prioritises retention (memorisation) as a method for learning, but sees that they can improve as a learner. The surface approach tendency is expressed by this student, but this demonstrates the narrowness of this descriptor because it is so static, whereas this student indicates they have recognised their need to develop. By contrast, the second appears to be struggling to cope with knowledge acquisition because they are overwhelmed by the amount they think they should accumulate.

In contrast to the challenges posed by studying, there were some very positive emotions expressed and the enjoyment of or in learning was emphasized by several students with an understandably clear preference for the practical skills-oriented learning experiences:

I enjoyed the one where [the lecturer] came round and demonstrated on us all and I enjoyed being in the skills lab.

(1: 55 - 56)

I think I learn more and more detail by doing, I am a doing-learner rather than a reading...actually practicing it again and again and then it goes in more, the more practice I get.

(3: 10 - 12)

However, the opportunity to read around subjects and self-study were seen as enjoyable aspects that could get you 'into' or lost in a subject and time could pass quickly during these periods of study. Also, assignments were seen as something to be enjoyed, not just a labour or requirement to fulfil:

I think doing this course you have a lot of time to do your own research don't you, and I think that has been really good for me because I enjoy it and the time goes really quickly because I get so into it. When we get assignments, I really don't mind getting them actually – I am quite happy to have assignments to do.

(1: 135 - 138)

Enjoyment was expressed in terms of changing or altering personal viewpoints, accommodating new ideas and applying learning in practice - learning was about seeing new things, seeing things in a different way, and going out and looking at people in a different way because *not everyone's lives are as easy as you think they are*:

I'm learning about new things and it makes you see things in a different way, like for example when we started the nursing and we had subjects about the patients and now go out and look at people in a different way because I just think that not everyone's lives are as easy as you think they are – are they? And it is the same with researching a subject I suppose and learn new things and see things in a different way.

(1: 164 - 169)

This transformative power of learning expressed here resonated strongly with the more advanced conceptions of learning in Marton *et al* (1993) in which learning is concerned with understanding the world through reinterpreting knowledge.

5.7 Evolution as a Knower

Becoming aware of changing as a knower was a key component of progression through the course coupled with development as a student, and the relationships between the conceptual and sub-categories are represented in figure 5.3. The term 'evolution' is used here because students reported there was a point or gradual awareness of change as a learner in their relationship with knowledge.

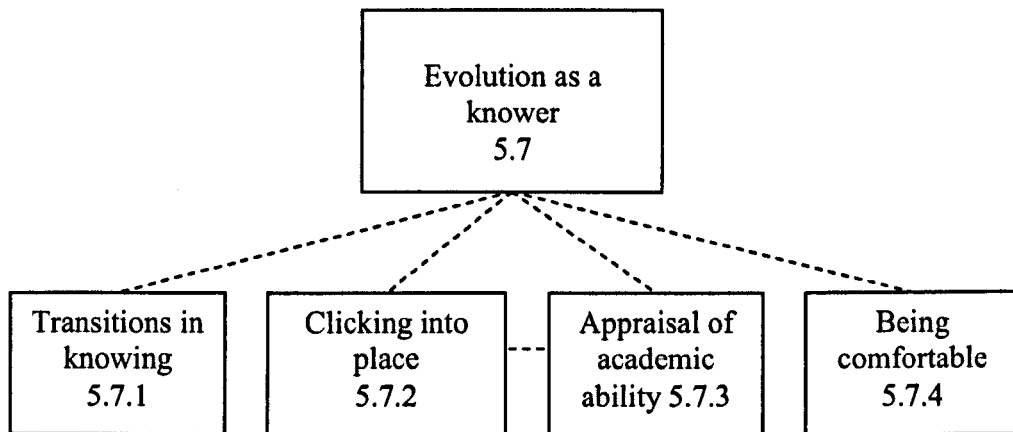


Figure 5.3: Categories contributing to dawning awareness of evolution as a knower.

Transitions were a key property of evolving as a knower, taking several forms and occurring at various points throughout the course, but particularly during the first year and then the first to second year move from CFP to branch, traditionally recognised as a major progression point on all higher education courses. Sometimes, the transition could be seen in terms that reflected the participants' confidence in themselves and perception of their ability, for example, from a *rubbish* knower to a competent one ready to be measured by the system:

..my knowledge of the human body is rubbish, but the more I read, obviously, it did eventually click into place, but I wouldn't want to be tested on it now.
(5: 197 - 198)

Example coding units	Example codes	Category
<p>..you're meant to read, read, read for a degree and I do probably do the bare minimum so, that's something, I'm obviously starting the third year now, I need to, I'm more motivated now, but whether it'll stick, I don't know. (5: 122 - 125)</p>	Clicking into place	
<p>..I think, I've got to the point now where I just want to get the degree, obviously you start off and you're aiming for a first, now I'm aiming for a 2:1, but if I get the next one down I'll still, you know, I think I'll just be relieved that I've passed so.. (3: 146 - 148)</p>	Transition point	
<p>I did always find things extremely easy in high school and A-levels, but I'd say now, I probably have to put more work in, but I mean..this is all totally different to what I've done before, (3: 154 - 156)</p>	Changing confidence	
<p>I was quite shocked that I got a reasonably bad mark, so I think I've learned that I've got to put more into it and can't expect to just scrape through. (3: 246 - 248)</p>	Innate ability	
<p>Yes, I don't know why, my instinct, feeling you just know you are doing it right, you get feedback, it is the whole sort of, the work is, it's not just knowing facts about, you know, how many vertebrae and where certain organs are in the body, it's not like that is it? It's about working with people about with a patient, it's different and I feel I will get that easier than learning facts. (3: 244 - 248)</p>	Appraisal of academic ability	Dawning awareness of evolution as knower
<p>over the past year I have already noticed some of the stuff I am coming out with is more than what I knew before, so I know it is sinking in.. (4: 113 - 114)</p>		
<p>I was struggling a lot on the infusions and could not get it at all and suddenly I was like 'hang on' a minute and suddenly I realized I could do them all.. (4: 80 - 82)</p>		
<p>..it's the same with researching a subject I suppose and learn new things and see things in a different way. (1: 167 - 169)</p>		
<p>...in the last year I have changed my mind because I always thought there are people that are more intelligent...but I...think it is the amount of work you put in yourself. (1: 181 - 183)</p>		

Table 5.3: Example coding units, codes and categories that informed the core category 'Evolution as a knower'.

In vivo codes in italics, participant identifier in brackets with line numbers or time code.

There was a recognisable point of transition, but this required effort, and it was known when that point or achievement was reached, the click into place, and then when that point was passed:

...that was something that all through school I had never got that so it was nice that it had suddenly 'clicked' and I can do it.

(4: 85 - 86)

Not only was it a signpost that marked where the student had come from, but it was a pointer of things to come, a 'wake up call', that scraping through was not enough, there was still work that had to be done to get through this course:

I do feel I could have done better probably on most of them so if I gave it more time, I expect it to be very quickly done and if I don't put the time in, I think that's where I fall down definitely.

(5 69 - 72)

That really shocked me because I thought I'd done a lot better, I think I got [grade] or [another grade] or something, and I remember going on to look, it was the communication assignment, and I was just like 'Oh my God!' That is really rubbish, and then you try and console yourself, well at least I passed and I haven't got to do it again. I think that was a bit of a wake up call...made me realise I'm going to have to put more into it if I want to get a better mark.

(5: 274 - 279)

If better marks meant more work would be needed, yet often this transition was not one where the knower had come to realise there were other ways of measuring achievement. This was probably a function of the course and that moulding or casting of them into a learner with a strategic orientation. Sometimes there was a clear point that stuck in the memory, such as an unexpected assessment result or mark that prompted a rethink about the approach taken to the assignment and to the course:

I was quite shocked that I got a reasonably bad mark, so I think I've learned that I've got to put more into it and can't expect to just scrape through.

(5: 246 - 248)

I was struggling a lot on the infusions and could not get it at all and suddenly I was like 'hang on' a minute and suddenly I realized I could do them all..

(4: 80 - 82)

Good, it is nice – I get this feeling that now I can do it. It is a good feeling suddenly I have mastered something that I have been struggling with, so I feel good after I've done it, pleased with myself.

(4: 88 - 90)

Sometimes there was a dawning recognition of change rather than an explicit awareness that a specific check point had been passed, and there was a cumulative effect of the course on the learner:

Yes, definitely a lot more focused, I understand the need for the reading whereas in the first year, I suppose you could say ... that you can get away with not doing much reading, and then you notice a distinct difference in the second year and I am now definitely seeing the need for reading and understanding the subject. For me in particular if you want to get something good out of it you have got to put the effort in and I do feel that the reading, like it or not, and I am not the greatest reader...if I want to get something from it and understand it properly...putting that reading into practice on placement proved to me great stuff and it does work.

(1: 148 - 157)

Int: Do you think ... your ability to learn can improve?

23: Yes, definitely, over the past year I have already noticed some of the stuff I am coming out with is more than what I knew before, so I know it is sinking in and I find myself... just talking to _____ about it, it is like I am confirming to myself that I know it and I have taken it in ..I have definitely changed over the last year.

Int: Do you think that has made you feel any different?

23: Yeah definitely, I feel a lot more confident in myself, I never really had a lot of confidence at all and, yes, I think it has made me a bit more confident.

(4: 112 - 121)

Demonstrating this aspect of student perception of change through interview extracts alone is difficult; the impression of the change in awareness came through extended sections of the interviews.

Being comfortable was a further indicator of a transition in terms of both relationships with knowledge and clinical practice, becoming comfortable with working in the clinical area rather than the discomfort of the novice learner on the initial placement:

Just learning new things, I feel, I think as well, I feel much more confident on placement now, because my first placement, I didn't have a clue, whereas now, I'm still obviously got loads and loads to learn but, a lot of it now is familiar so you feel more comfortable.

(5: 252 - 255)

I am happy to see everyone's point of view and yes, I think I am quite good at that, I think. I could see lots of people's point of view on certain things...

(3: 73 - 75)

From an academic viewpoint, this was also recognising when too much material was collected for assignments and becoming more sophisticated at sorting and gauging the value of material:

Yes, yes you do because you can read a book obviously and you will see things in there that you think 'I will read it' and you go off on your tangent and then you have to come back to filter it back down to what you need to get done...Although as the course progresses I am getting a lot better on being able to focus on way I need to know and I don't go off on these tangents all over the place whereas in first year I was all over the place. I found it difficult to know where to concentrate my efforts.

(2: 134 - 140)

Students appeared to become more comfortable as they underwent transitions, which would seem obvious on initial consideration, but there was an implication that they had to undergo the rites of passage of the transitions to realise they had progressed and to become comfortable with knowledge and studying.

For some, there was the promise of a final metamorphosis on completion of the course, which seemed to like the light at the end of the tunnel - there was a clear indication that there would be a fundamental change from student to staff nurse on qualification when they would enter *proper practice*:

I always think that when you qualify is when you start learning. When you are doing proper practice and I always think that the important things are going to come to you when you are in proper practice. Basic important things, yeah, when you are studying – training, but other things will come. I do not want to stress myself about that.

(1: 48 - 52)

The students almost regarded the change from student to staff nurse as a form of metamorphosis, that is, they would in one role one day and change the next day into something new. The change was optimistically seen as something that was inevitable and not to be worried about, it was a way off and would come in time.

5.8 Adopting an Individual Learning Strategy

Adopting an individual learning strategy was a key feature of the interviews as a means to cope with the demands of the course and family. A strategic approach was commonly stated as the chosen approach to studying:

Int: Do you ever think 'I'd like to go and read more about that'?
Some things...to be honest with you, when we get an assignment I just focus mainly on the assignment and nothing else.

(1: 149 - 150)

I am quite bad in that I don't do as much general reading as I should, I more, I focus more on assignments, so that's probably when I do the most reading...

(5: 16 - 20)

Although the assessment driven strategy was often articulated as being the principal task-based approach to studying, the decision to adopt it did not always appear to be through choice.

There were hints of a hidden learner who wanted to know and engage more, but resources and family pressures were amongst the constraining factors. It was as if they were trying to break out, they would seek advice on what was supposed to be read from their guide, someone who knew what they should be doing and tell them which direction to take. In more sophisticated conceptions, the need to seek guidance was resisted and seen as the option of last resort:

If I get stuck I will go and have a word with whoever is tutoring me, being the type of person I am generally that would be my last resort.
Int: Why?

I do not tend to come to my supervising tutor until I am absolutely stuck and do not know where to go after that. I have only come across that once so far and it has been helpful...

(2: 55 - 60)

Being able to navigate through the choppy waters of studying, learning and assessment production was a set of skills that should have been gained by that point.

Studying was something that could be mastered through practice and persistence and barriers to learning could be overcome with effort and application. It was possible to improve as a learner, it was not just about being naturally clever:

...in the last year I have changed my mind because I always thought there are people that are more intelligent...but I...think it is the amount of work you put in yourself.

(1: 181 - 183)

Some students saw their past experience as an advantage, and perceived previous occupations and relevant work experience as a factor which made them more able to cope with the demands of the course than some of their younger colleagues:

I think certainly for this course, for nursing, being a mature student has helped me massively, in fact, very often, how some of the younger ones do it, I just think hats off to them to be honest. I think having some life experience and being able to relate that to peoples' social backgrounds and what they do and different things like that has certainly helps - yes.

(2: 84 - 88)

Although students developed individual-specific approaches to their learning, there was also a collective approach with the cohort. This provided support and was an important coping strategy that was much less conditional and negotiated than that from the family, and the effects of peer support should not be underestimated. Students did not attend school or study in isolation and much support was drawn from the cohort, both in the classroom and school context and whilst out of school on clinical placement:

Yeah, definitely, obviously everyone was sort of in their own little group, but even apart from that, um.. you'd sort of.. I would feel quite comfortable asking someone missed notes or likewise people, we all seem to be able to ask

questions, what are we meant to do on this? Or how about this? I think that's nice.

(5: 262 -265)

...there's a social atmosphere, and the way everyone sort of gels is definitely a big influence, and I would feel totally comfortable going up to anyone and saying 'what did I miss there?' Or asking advice or anything..

(5: 269 -171)

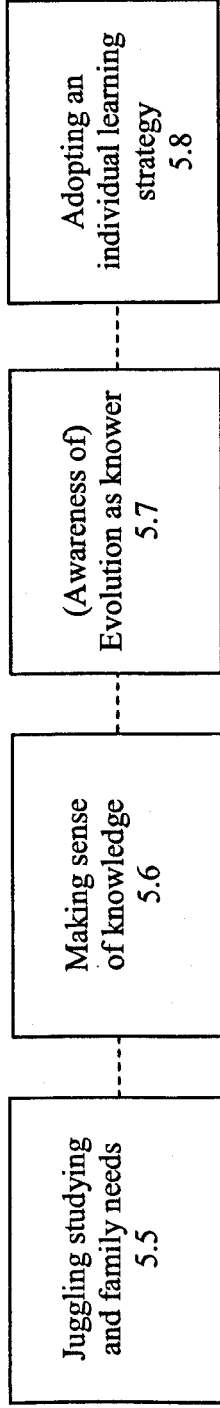
...we feel we can chat and there is support there obviously just that social interaction and that does give you support. It gives you that confidence to say, well yes, I'm not really on my own here, who's struggling on this, struggling to understand that, by talking it through it does help.

(2: 111 - 114)

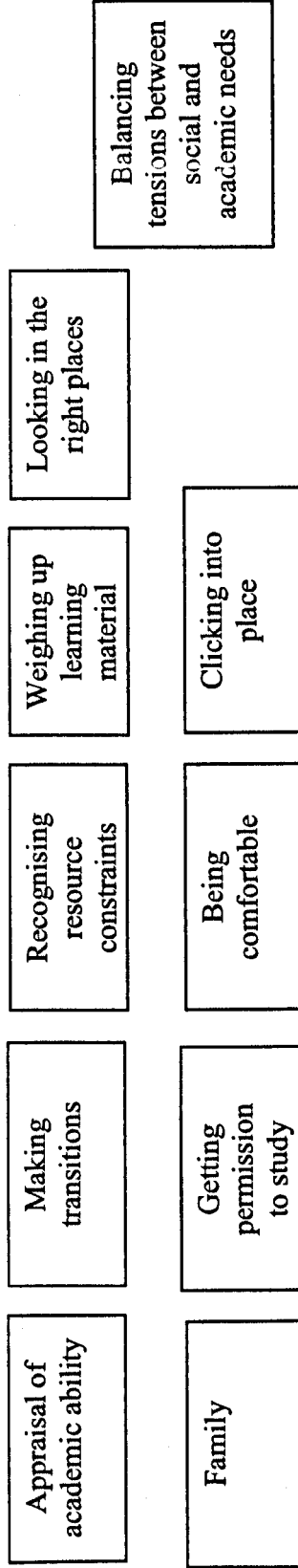
This could take material forms, such as catching up on missed sessions or notes, or talking through and discussing ideas. There was also the implication of gaining strength from the group, which could be missed when they were apart during placements. Free time for study was regarded as an important part of the day, and lunchtime gave time to adjust between different topics or subjects and a forum for discussing new ideas or issues about the course.

Substantive Theory

Conceptual categories



Categories



Codes

Figure 5.4: Development of final conceptual categories from the grounded theory coding and units of analysis.

5.9 A Theory of Student Approaches to Studying and Personal Epistemologies

The integrative diagram in figure 5.5 presents elements of the grounded theory in a visual form that identifies links and relationships identified between categories and subcategories (Strauss & Corbin 1998). Guidelines for constructing diagrams are sparse (Charmaz 2006) and Strauss & Corbin (1998) leave it to the 'analyst to develop his or her own style or technique' (p223). Despite this apparent vagueness which can be regarded as a spur for creativity, the Strauss and Corbin (1998) axial coding paradigm which includes examining context, conditions, actions, interactions and consequences suggested a framework to organise and present the categories in a diagrammatic form.

The arrows and lines in this diagram indicate linkages between categories and the larger boxes incorporate similar and related categories. These divisions are broadly comparable to the 3-P model (Prosser & Trigwell 1999) presented in chapter one, figure 1.1. Time is represented as running from left to right, but the contexts and processes may be subject to change and could flow back and forth. In this respect, the theory as a whole is dynamic rather than representing a linear trajectory. The core category 'Juggling studying and family needs' is intended to incorporate and explain all the other categories. The theory is organised with context and the broader conditions in which the core category is situated on the left of the diagram. The central actions and interventions are derived from the core conceptual categories presented in figure 5.4 and reflect processes at the heart of the theory. Consequences are the outcomes of the actions and interventions. Evolution as a knower and the sub-categories cross actions, interactions and consequences because they are concerned with changes in knowers resulting from making sense of knowledge.

The presentation of the grounded theory in diagrammatic form is an oversimplification of the complexity of the different elements and processes it represents, although parsimony of description is a desirable characteristic of a substantive theory (Glaser 1978). The double-ended arrow between actions and interactions and consequences at the top of the diagram indicates the overlap between these sections of the theory. Arguably, juggling studying and family needs could be regarded as a

consequence following the contexts and conditions. Also, learning strategies are dynamic and responsive to external events and processes so will be modified as students undergo evolution as knowers.

Although it a simplification of a complex social process, this diagram serves to underline the web of issues and themes that were raised during the interviews and begins to illustrate the relationships between the different categories of the grounded theory. These will be linked to the results from the survey in the following chapter.

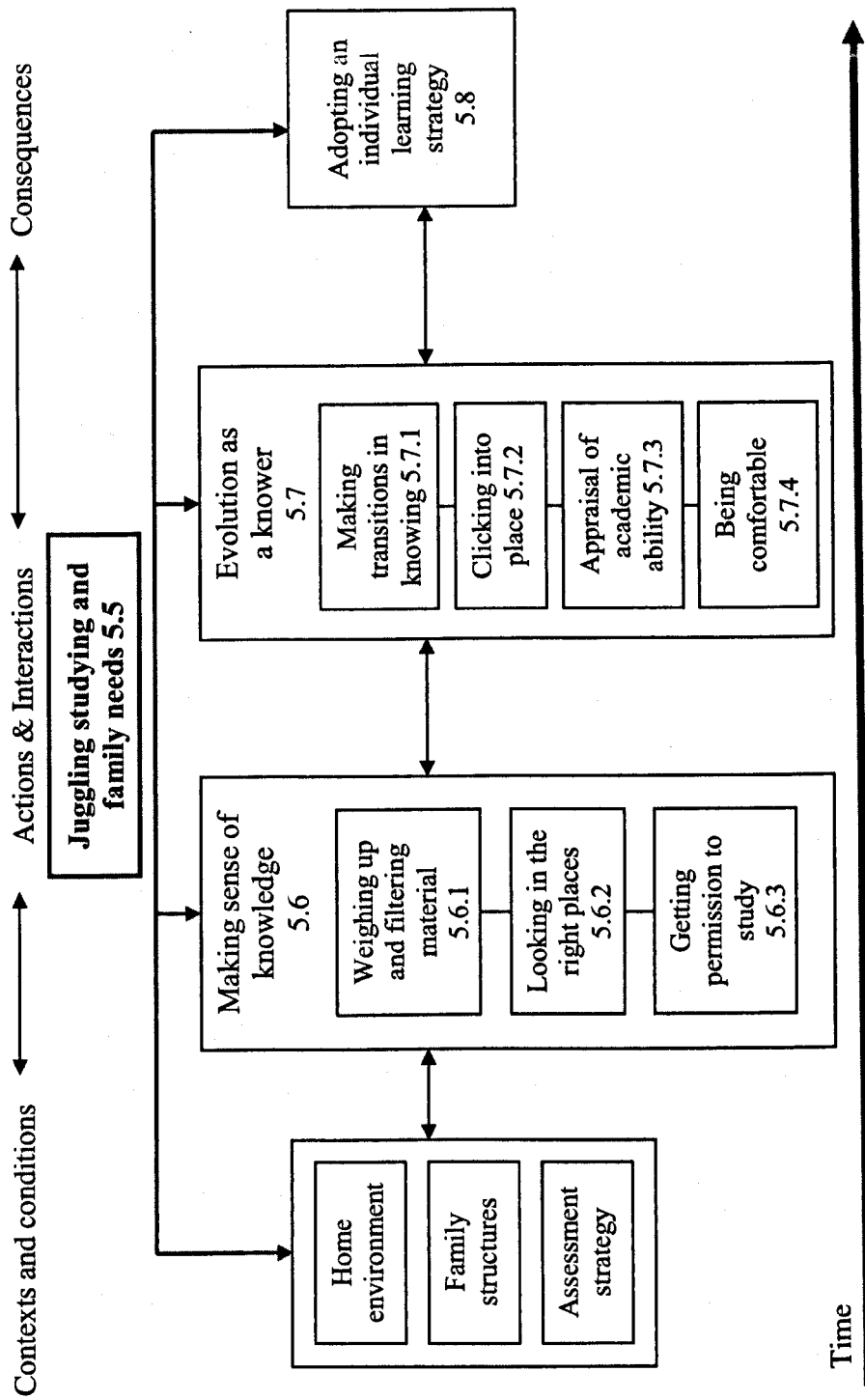


Figure 5.5: A diagram representing processes and relationships between student nurse personal epistemologies and their approaches to studying. Numbers adjacent to categories refer to the chapter sections outlining their development.

5.10 Limitations of the Study

As with the survey element of this study, a key limitation is a focus on one small group of students from a single institution, although the final analysis and theory are not intended to be measured or validated by any quantitative methodology criteria as such. However, this limitation can be regarded as one that adds credibility to the study because of the intimate knowledge of the institution and of the participants' context as they lived and worked in that institution. The theory was intended to be a theoretically transferable view of the processes that were occurring in relation to studying and knowledge beliefs and was not meant to be generalisable.

The student sample was derived from volunteers, so it is likely there were participant cases who could add to the theory that were not included in this sample. As previously discussed, an extension to the sample could be the inclusion failing students or those on time out from the system, although this would raise a new set of ethical issues in relation to the researcher participant relationship. It was not possible to link theoretical sampling to the survey results because the questionnaires were anonymised unless students completed the consent to interview. Identification of student participants in the survey, particularly those who were members of the different clusters, would have enabled more elaboration of the grounded theory.

A further limitation was the limited scope of the study in light of the criticism of learning styles research by Coffield *et al* (2004) and its failure to address the influence of socioeconomic, gender and race on student learning. Although this study has not addressed race issues and it was not the intention to do so, there were clear issues that arose concerning gender and socioeconomic issues that are not ignorable by nurse educators. It is accepted that these are not necessarily new issues, but this study does examine them in a different light in relation to the research questions. This study has highlighted that an important focus for further research could be to explore how gender issues affect student nurse approaches to studying and epistemological beliefs from an appropriate methodological viewpoint. The influences of socioeconomic issues and ethnicity on student nurse studying are further areas for research and some aspects have been addressed, for example the effect of part-time work (Rochford *et al*

2009), but investigating these areas present major challenges in terms of methodological sensitivity and sampling.

5.11 Chapter Summary

An investigative approach built around constructivist grounded theory provided a lens through which the research questions in this thesis could be further studied following the survey. The approach provided a different perspective than that of the survey on the research questions:

- What are the characteristics of student nurse personal epistemologies?
- What are the relationships between student nurse personal epistemologies and approaches to studying?

What this dataset and analysis has added to answering the research questions can be summarised as these key findings:

- Issues concerning personal epistemology and student approaches to studying were not only articulated, but also reasons why particular knowledge beliefs held or identifiable strategies were adopted became apparent with particular reference to the effects of family life on studying.
- These social processes were based on complex transactions between the different members of the family structures and they deeply influenced both student attitudes and reported behaviours in ways which were indicated, but not explained by, the survey inventories.
- The negotiations between the student and family members were not straightforward or uncomplicated and often invoked strong feelings and emotional responses. In particular, students reported feelings of guilt when family time was used for studying, particularly when students were parents. This could lead to role

and identity conflicts and particular strategies for learning and acquiring knowledge, which are discussed in the next chapter.

- Learning how to study was a negotiated process that involved seeking permission from teachers and processes to satisfy a need to collect knowledge.
- Enjoyment was expressed as a positive emotion felt during studying and an important factor related to beliefs around innate ability, persistence at working at studying or with a problem. Being comfortable with knowledge was also inextricably tied to being comfortable in clinical placement.
- Particular transition points were identified as precipitators of change in attitudes of the students toward studying and potential modifiers of knowledge beliefs.

The results from the surveys and the grounded theory are brought together in the next chapter. Findings are used to provide a multi-dimensional explanation of the characteristics of student nurse personal epistemologies and the relationships between those belief systems and approaches to studying.

5.13 Conclusion

To answer the initial question, this analysis adds a new perspective on the effects of family and social networks on studying and a tentative glimpse at how studying and epistemological beliefs interact in these processes. Family are not only a stressor in terms of distress, but an important contributor to successful studying and learning and thus an important source of eustress. This knowledge and understanding of how studying is negotiated in a social context is important for nurse and higher education as Coffield *et al* (2004) assert in their report into learning styles:

The main charge here is that the socio-economic and the cultural context of students' lives and of the institutions where they seek to learn tend to be omitted from the learning styles literature. Learners are not all alike, nor are they all suspended in cyberspace via distance learning, nor do they live out their lives in psychological laboratories. Instead, they live in particular socio-economic settings where age, gender, race and class all interact to influence their attitudes to learning. Moreover, their social lives with their partners and friends, their family lives with their parents and siblings, and their economic lives with their employers and fellow workers influence their learning in significant ways. All these factors tend to be played down or simply ignored in most of the learning styles literature.

(Coffield *et al* 2004, p142)

This study does not directly address socioeconomic, race or class issues, although some aspects of these are mentioned in interviews, particularly financial concerns, however, it serves to emphasise the importance of these areas for further investigation.

Chapter Six

Synthesis of Findings And Recommendations

6.1 Introduction

The aim of this mixed methods study was to provide context-rich elaboration, clarification and explanation of how student nurse personal epistemologies influenced their approaches to studying. Inherent in this was a need to describe and define student nurse personal epistemologies in a meaningful way. Thus, the findings could be used to better inform knowledge and understanding of this phenomenon and be useful to educational theory and practice. The strengths and differences of the 'reductionist' quantitative and the 'holistic' qualitative approaches had potential to provide alternative perspectives to illuminate the research questions (Woolley 2008). This could be achieved through the mixed methods design of this study by expansion of the results through examination of complementary findings. This chapter is therefore concerned with integrating the findings from the survey and grounded theory into a coherent account and discussion of findings from this research.

The preceding chapters have presented findings according to the underlying traditions of the methods and methodology (Morse 2003). Here, the aim is to re-present findings in a way that emphasises what is new in this research; personal epistemology and deep and surface learning alone are not new concepts in educational research. However, what is new for nurse research and knowledge is the exploration of relationships between the two areas and the emphasis provided by discussing the quantitative results in the contextual findings from the grounded theory.

6.1.1 Integration Procedures

There are several ongoing lines of discussion in the mixed methods literature which focus on broad philosophical and methodological issues (Bazeley 2009, O’Cathain 2009). There are limited recognised and defined techniques to inform the process of integration or combination and these terms are not well-defined in the literature, although there is guidance on methods emerging (O’Cathain *et al* 2010). The integrated analysis presented here is conceptually founded on Mason’s (1994) ‘problematism’ approach, which asks questions of the data through generation of propositions and questioning those propositions to address the research questions. The propositions are a means to pursue and test themes or threads of enquiry from both datasets and more focused statements were departure points for discussion (Creswell & Plano Clark 2007, Woolley 2008).

6.1.2 Summary of Key Findings

In summary, the main issues arising from the quantitative and qualitative components of the study were student nurse approaches to studying were demonstrated to be related to underlying personal epistemological beliefs. The results of the survey analyses were broadly in agreement and comparable with reported results in the personal epistemology and learning styles literature. The most significant findings were concerned with student beliefs in their ability to change as learners and beliefs about the speed and source of knowledge acquisition. Further relevant processes related to epistemological beliefs centred on the role of the teacher as a guide through the ‘morass’ of evidence and literature, outlined in the categories ‘Making sense of knowledge’ and ‘Evolution as a knower’. In addition, the grounded theory demonstrated how students’ approaches to study were influenced by the tripartite influences of the self, family and teacher, and the institutions of the home, the university and the clinical placement environment.

With regard to personal epistemology, the overall picture from this study is that student nurse knowledge beliefs can be described by the rEBI, but the context in which they learn mediates how these beliefs influence their study approaches. The

quantitative results from the factor analyses tentatively suggest the beliefs may be more fine-grained and multi-factorial than Schommer's (1990) model indicates and the instrument can presently discriminate. However, the evidence suggests the five-factor independent belief system (Schommer 1990) provides a pragmatic and parsimonious shorthand for characterising these beliefs and therefore, is useful as a tool for promoting dialogue. This aspect of this study is consistent with the literature at a general level (Jehng *et al* 1993, Clarebout *et al* 2001, Bråten & Strømsø 2005) and they contribute to this area by adding to what is already known about how student nurses learn in higher education and how this occurs in a social context. Knowledge and understanding of these processes can assist in indicating areas for intervention in the pre-registration programme and the design of curricula.

These findings support previous research at a general level in that student approaches to studying appear to be descriptors of a whole system and reflect the assessment strategy of a course, student social circumstances and to some extent in this study, their clinical placement experience. The results reinforce the assertion that approaches are not just a labelling scheme to be applied to individual students as a diagnostic or deficit marker (Tait *et al* 1998). This is an important aspect of learning styles for nurse education to consider because of the diversity of students enrolled on programmes, emphasised by the wide range of demographic information from the student population in this single institution. Educational approaches and curriculum design have to take account of as many factors influencing student learning as possible in order to provide effective and enjoyable learning experiences (Gibbs 2010). This is important because of increased interest in the first year at university (Walker *et al* 2009) and because the student experience has assumed crucial importance in the National Student Survey in the UK since 2005 (Williams & Kane 2008).

6.2 Status of data and strength of claims

The two sets of data and results presented in the preceding chapters were developed during the mixed methods design with the purpose of complementarity and expansion, rather than solely a validity check as has been discussed in the methodology. Prior to the analysis, a summary of the characteristics and status of the data sets and the basis of the strength of the claims that can be made from each is useful (table 6.1). This step is included to act as a checkpoint to facilitate questions about how the different elements from the datasets and analyses could operate together in practice, that is, how they could be integrated. It provides an opportunity to review the theoretical stance and fundamental assumptions underlying the constructions of the datasets and analyses assumed in this study before proceeding to the 'gluing together' stage of the integration (Mason 1994).

Table 6.1: Status of data and strength of claims (Mason 1994).

	Survey	Grounded theory
What data?	Likert scales, demographics	Interview transcripts
Data on what?	Questionnaire items, subscale scores and latent variables, factor structures, group differences, regression analyses	Conceptual categories Rich descriptions of social processes Substantive theory
Claims based on what?	Mathematical and statistical enumerative logic	Constructivist interpretivist analysis
Strengths	Ability to make claims and predictions; generalisability	Credible claims about understanding social processes
Limitations	Narrow and restricted scope Depersonalised	Limited generalisability

The datasets had areas of commonality which became apparent when the data were analysed. Pursuing those threads from the separate analyses was the aim of the integration. As outlined, problematising the data informed the technique used to explore similar themes and to pursue them from the viewpoints of the different analyses using a statement about a conceptual issue arising from the data (Mason 1994). This was achieved by generating propositions and questions from the results to enable a more integrated exploration of themes from the survey and the interviews.

The survey results pinpointed key features about the descriptive characteristics of student nurse personal epistemologies and their approaches to studying, whilst the grounded theory provided broader contextual information and potential explanations why particular approaches might be used or the influence of epistemological beliefs held. The propositions and questions were tools to unpack the data from a variety of perspectives and promote greater depth of understanding.

6.3 Problematising the data and results

The problematising approach was a means to explore the research questions holistically by integrating findings from across data sets. The first research question was concerned with how student nurse personal epistemologies can be described and what form they might potentially take:

- What are the characteristics of student nurse personal epistemologies?

The second is concerned with how these beliefs about knowledge and learning influence deep and surface processing evidenced as approaches to studying:

- What are the relationships between student nurse personal epistemologies and approaches to studying?

Re-examination of the summary of key findings in the introduction to this chapter provided a broad basis for development of the propositions:

- Student nurse personal epistemologies are related to approaches to studying, particularly those beliefs concerned with the ability to change as a learner, the rate of knowledge acquisition and seeking approval from authority.
- Approaches to studying are descriptors of a whole system and reflect the assessment strategy of a course, student social circumstances and to some extent, clinical placement experience. They are not diagnostic labels to be applied to individual student nurses to characterise deficits in ability.
- Nurse lecturers need to more explicitly consider student nurses' individual approaches to studying and their epistemological beliefs in order to accommodate the diversity of the current student population.

Further focused sub-statements were derived from the results of the survey and grounded theory studies:

- *Students who adopted surface approaches to study would be more likely to have beliefs in quick learning and an expectation that knowledge would be handed to them by an authority.*
- *Student expressions or indications of belief in their ability improve as learners would be in alignment their study approach.*
- *Students who were better able to negotiate or organise time to study would express less guilt and issues around role conflict.*
- *Student epistemological beliefs would become more sophisticated as they progressed through the pre-registration course.*

The statements may appear normative, but should not be seen as definitive or as measures to assess or diagnose students. Instead, these are treated as points of departure to facilitate exploration and unpacking of the results and the questions which were raised by bringing the two datasets together.

6.4 Proposition 1 - Student nurse personal epistemologies are related to approaches to studying, particularly those beliefs concerned with the ability to change as a learner, the rate of knowledge acquisition and seeking approval from authority.

This study has demonstrated epistemological beliefs can be measured by the rEBI and can be inferred from interviews with student nurses. Four beliefs were apparent in the factor analysis which are comparable with findings from studies previously carried out in the US (Jehng *et al* 1993), Europe (Bråten & Strømsø 2005), Africa (Sitoe 2006) and Asia (Chan & Elliott 2002). The composition of the individual factors varies across all these studies, for example Sitoe (2006) did not find an innate ability factor, which suggests there are cultural issues that require further investigation.

In answering the first research question, the rEBI and grounded theory can be brought together to characterise the epistemological beliefs of the students in this sample. The qualitative findings bore a similarity to those reported in Hofer's (2004a) study at the level of individual beliefs which was consistent with Schommer's (1990) model. The rEBI subscale scores were very similar to the mean EQ scores in Bråten and Strømsø's (2005) research with students studying education and business studies. However, Hofer (2004a) structured her interpretation around three dimensions from Schommer (1990) and an alternative dimension, justification for knowing. Bråten and Strømsø (2005) adapted Schommer's (1990) Epistemological Questionnaire following factor analysis and included certainty of knowledge, speed and control of knowledge acquisition and knowledge construction. In this study, the certainty of knowledge factor did not emerge in the quantitative analysis, whereas students expressed preferences for structured knowledge when learning about anatomy and physiology during the interviews. Direct comparisons with these studies should be treated with caution, but the student nurses in this study did not appear to be significantly different in their epistemological beliefs to those in published research. This suggests beliefs are general rather than discipline specific (Muis *et al* 2006).

A central finding in this study with regard to characteristics of personal epistemologies arose from the cluster analysis. This indicated different sub-

communities in the data which were not clear cut and that the mean instrument scores for the whole group of participants did not reflect. Arguably this was the most significant quantitative finding and demonstrated how the mean or median scores for the total population in the sample smoothed out the results and obscured the diversity of the belief systems held by the students. This finding allied to the grounded theory begins to address the criticism levelled at learning styles research by Coffield *et al* (2004) and Haggis (2003), specifically that they give only decontextualised views of students. Also, this enables some deconstruction of Haggis' (2003) criticism of the deep/surface metaphor which is argued to favour an elitist view of higher education. The distinction is not so clear, and speculatively, it is likely the tendencies expressed by students toward a particular study approach fluctuate with context and are more dynamic than indicated here.

In relation to the second research question, the analyses of both datasets indicated significant relationships between student nurse epistemological beliefs and their study approaches. These were evident both in the cluster results and the regression model in the quantitative analysis and in the grounded theory, in particular the category 'Evolution as a knower'. The key effects of epistemological beliefs on student nurse study approaches in this sample were threefold with regard to:

- How student nurses perceived their ability to improve as learners;
- How quickly the perceived knowledge could be acquired;
- How they perceived the medium and process through which that knowledge was obtained.

The regression results reiterated here indicated the factors innate ability, simplicity of knowledge and omniscient authority were the main epistemological beliefs measured by the rEBI that predicted dominant study approaches:

- Students indicating less sophisticated beliefs about the simplicity of knowledge and in innate ability tend to adopt a surface approach to studying – that is, higher

scores on the simple knowledge and innate ability subscales predict a surface approach to studying.

- Belief in innate ability was negatively associated with a deep approach, and quick learning had a very small negative effect in relation to the deep approach to studying.
- Belief in quick learning had a positive (but not statistically significant) relationship to the surface approach to studying.
- Students who indicated higher scores on omniscient authority tended to adopt strategic or surface approaches to studying.

These results add to existing knowledge in nurse education research focusing on student nurse approaches to studying (Snelgrove 2004, Mansouri *et al* 2006, Leung *et al* 2008) and to the body of research around epistemological beliefs and their relationships to motivation, self-regulation and study approaches (Schommer-Aikins 2004, Ravindran *et al* 2005, Bråten & Strømsø 2005, Zhu *et al* 2008). The results from the cluster analysis in terms of the percentages of students in each cluster were highly similar to results in Mansouri *et al* (2006) and approximated those in Leung *et al* (2008). It should be noted that those researchers did not use cluster analysis to partition their samples, but instead used the dominant study approach score to allocate students to common groupings. However, the current study reinforces those previous findings which add to the validity and reliability of these results. These broaden nurse education research knowledge in this area by the addition of the findings about personal epistemology and their impact on study presented alongside the findings and issues raised by the grounded theory.

Although the effects of epistemological beliefs on study approaches were significant in quantitative terms, they were relatively small in terms of effect size. Furthermore, they only accounted for small amounts of explained variance (4-17%) in the statistical model, although the relationship between simple knowledge and surface learning is

comparable to previous research (Cano 2005). Small effect sizes in this type of research are reported to be not unusual by Cohen (1988), who regarded this as inevitable as a result of problems with measurement of psychological attitudes and beliefs, and the 'subtlety' of the issues examined. Richardson (2006) also recognises that small effects might be of theoretical importance because of the issues of background noise arising from measurement that 'bedevil' educational research. This is an effect of real world research in 'messy' settings which produce a multitude of interacting variables and statistical techniques may be applied whilst violating underlying principles (Robson 2002). Thus, there is scope to consider what else in the background, or 'random variation' in the student sample, might be having an effect on the relationships between epistemological beliefs and approaches to study and the grounded theory provides a means to do so.

The findings from the grounded theory study can be viewed as complementary and build and expand on the survey results with regard to this proposition. Although these inferences cannot be further 'tested' as such in this study, comparisons with previous research adds to their validity or can form the basis of new research questions. The grounded theory complemented the quantitative results when considered from the viewpoint of further 'sub' propositions or statements. The following statement was concerned with exploring the surface approach to studying and the assumptions that could be made concerning epistemological beliefs:

- *Students who adopted surface approaches to study would be more likely to have beliefs in quick learning and an expectation that knowledge would be handed to them by an authority.*

It is not unreasonable to expect or hypothesise that students who indicated a surface approach to learning would also have less developed personal epistemologies, particularly beliefs that knowledge should be acquired quickly without effort and they should be taught what they are required to know. Whilst this assumption might intuitively be expected to be evident from the survey results, the pattern of differences between the clusters of students was not clear cut and did not support this proposition.

This raises questions about the reasons why approximately one in five students in this sample indicated a tendency to adopt a surface approach. Although this may be viewed as less desirable than deeper engagement, students in this sample had other qualities in terms of their epistemological beliefs that did not entirely 'fit'. These could be examined to see what this group of students had in common with those who indicated other study approaches.

The one area where students in the surface approach cluster did report significantly higher scores and which differentiated them from those in the other clusters was on the innate ability subscale of the rEBI. In other words, these students indicated they viewed their ability to change as learners was limited and, in effect, was something they were born with, or was genetically pre-programmed. They also indicated high scores on beliefs in simplicity of knowledge, in common with the cluster who adopted a strategic approach to study. However, what was notable was the omniscient authority and quick learning subscale scores were not significantly different to those students in the cluster who indicated a deep approach to study.

The grounded theory provided an alternative perspective regarding these findings which could expand what was known about the clusters. In particular, knowledge of how students in the cluster indicating a tendency to a surface approach differed to the other clusters was of interest. The key characteristics of a surface approach (Entwistle 1988) are defined as tendencies to;

- Memorise information needed for assessments;
- Have an intention to reproduce;
- Fail to distinguish principles from examples;
- Treat tasks as an external imposition;
- Focus on discrete elements without integration;
- Be unreflective about purpose or strategies.

These characteristics are related to the first three conceptions of learning (Säljö 1979) linked to personal epistemology by Entwistle and Walker (2002);

- Learning brings about a quantitative increase in knowledge (knowing a lot);
- Learning is memorising (storing information for easy recall);
- Learning is about developing skills and methods, and acquiring facts that can be used as necessary.

The grounded theory findings are consistent with and reflect these characteristics and conceptions, but in addition include references to epistemological beliefs. The collecting process in the category 'Making sense of knowledge' has been described in chapter four and is related to quantitatively increasing knowledge, which is associated with memorising facts. In this category, contrasting student viewpoints incorporate epistemological beliefs about how knowledge is perceived and acquired (simple knowledge and quick learning). It is in the perception of the ability to improve as learners through investment of personal effort and time (innate ability) where differences can be seen. This example serves to also illustrate a key feature of Schommer's (1990) model, in that the beliefs can develop asynchronously.

Gaining permission from an authority was also an important influence on studying and learning in relation to the category 'Making sense of knowledge'. Some students reported they needed this permission to study particular subjects or areas from a tutor or assignment supervisor, which is related to beliefs about omniscient authority. On the other hand, those students with more experience who were at a later stage in the course could see this action as a last resort because they wanted to work things out for themselves. The reason permission was sought was because they wanted to be successful in their assessments, which is a feature of a strategic approach and arguably all students want to achieve this aim. They did not want to be side-tracked into gathering and processing interesting but what they regarded as irrelevant information. These findings are consistent with exploratory case studies of first year psychology and chemistry students (Hofer 2004a), which serves to underline the importance of studying this particular aspect of student behaviour.

The interview findings resonate with Women's Ways of Knowing (Belenky *et al* 1986), which further validates the grounded theory in this study. This developmental model was both a reaction to, and development of, Perry's (1970) study, and arose following research in the United States in relation to women at a time when there were changes in welfare support that encouraged more women to enter education. It is regarded as a feminist epistemology (Nelms & Lane 1999) and as being less hierarchical than Perry's (1970) scheme. There is greater focus on the role of self-concept in relation to others and there is more attention to sources of knowledge (or authority) than Perry (1970). Also, care and empathy are emphasised important qualities in the knower in more developed ways of knowing when knowledge becomes more integrated with the self, rather than being accepted literally.

Women's Ways of Knowing (Belenky *et al* (1986) has undoubtedly had an impact on how knowledge is viewed in nursing (Sweeney 1994, Leight 2002, Young 2008). The results of this study, which includes reference to gender roles, are consistent with positions in this model. There is clear resonance with ways of knowing in the work of Davies (1995) who criticized the gendered position of nurse education and in a qualitative study by Nelms and Lane (1999) of student nurses which focused on the relationships between the caring roles of nursing, connected knowing and critical thinking. Wall (2008) drew further comparisons between this feminist model and the tensions inherent in the drive towards positivist evidence-based nursing which she perceives as 'marginalising' the tacit knowledge of nursing and its associations with a masculine view of what constitutes knowledge. Evidence for clinical practice is not solely derived from scientific research and the relationship between practitioner and patient is reliant on empathy and trust, which in turn contributes to nursing knowledge (Rycroft-Malone *et al* 2004). Again, these are not necessarily masculine values and issues related to gender roles and the gendered nature of the institutions which the students experienced were evident in the interviews and grounded theory findings.

The process of studying in the category 'Making sense of knowledge' shares features in common with 'received knowing'. This way of knowing arises from dualism, where truth is unambiguous and absolute, external and objective and the student is

completely dependent on the teacher (authority) to give them the information. However, students can feel disconnected from that authority figure. Students are characterised as being receptive to knowledge, but want everything recorded and measured, to be stored and reproduced (such as multiple choice questionnaire exams) and will not question or use knowledge with confidence. The category 'getting permission' was similar in that students could see knowledge as collectable bits of information in the form of books or papers. Permission from authority was sought, but as the students' confidence in their abilities increased, this seeking permission decreased. There is no indication of disconnection from authority from the interviews.

However, there were also references in the interviews that were consistent with 'procedural knowing' in which gaining knowledge is a process that requires effort and is not just about acquiring facts. Not all interpretations are right or valid and this way of knowing is characterized by interpretation, and comparing and contrasting differing positions of knowledge. Within the position of procedural knowing there are two qualitatively alternative modes: separate and connected knowing. Separate knowing is detached, concerned with impersonal thinking, for example knowing about hard science, whereas understanding of the meaning and truth of the object of attention is central to connected knowing. Separate knowing requires validity, with objectivity achieved through detachment, whilst connected knowing may require suspension of one's personal beliefs, or effort, in order to adopt those of the other person or viewpoint (Belenky *et al* (1986).

These ways of knowing have similarities to the higher level conceptions of learning (Säljö 1979);

- Learning is about making sense of information, extracting meaning and relating information to everyday life;
- Learning is about understanding the world through reinterpreting knowledge;
- Learning has a dimension about transforming as a person;
- Learning as changing the person and the world.

Procedural knowing can be exemplified in this study in the excerpt from the student quoted previously who said 'I am greedy for books' (20: 48 – 52). This is about collecting information, but there is also a sense of wanting more in order to understand, rather than to satisfy a need to feel comfortable through amassing information. There is an explicit reference to a quantitative increase in knowledge, which will require some memorisation, but there is an implicit sense that there is sense-making and interpretation, wanting to see others' viewpoints.

Connected knowing has an emotional component and incorporates empathy towards another's position. It is concerned with trust and sharing the experience, which is captured in this example who said they could see things in a different way and 'not everyone's lives are as easy as you think they are – are they?' (5: 164 – 169). The resonance of the findings here with the epistemological positions in Women's Ways of Knowing (Belenky *et al* (1986) also adds to the credibility and authenticity of the grounded theory findings. It also suggests that a synthesis of Schommer's Independent Beliefs System model (1990) with Women's Ways of Knowing (Belenky *et al* (1986) could be a means to move forward personal epistemology into a form useful for nurse education. This combined model could provide characterisation of belief systems, which could be further elaborated through work such as this study and Greene *et al* (2008), with a socially contextualised framework to classify development of personal epistemology.

The statement at the beginning of this section could be regarded as a reasonable assumption to form the basis of a hypothesis, however, the grounded theory findings serve to illustrate the variation in beliefs and how they are more dynamic than the survey scores would indicate. Ability to change as a learner was evident in discussion of the last statement in relation to a surface approach to study and epistemological beliefs. Innate ability is explored further through this next statement:

- *Student expressions or indications of belief in their ability to improve as learners would be in alignment with their study approach.*

Scores on the innate ability subscale (summarised in chapter four, table 4.14) were the one rEBI indicator that was statistically significantly different for all three clusters. Innate ability can be defined as a belief in the ability to change as a learner and if it is less developed, then that individual is more likely to believe they cannot change and their ability to learn is predetermined at birth. Therefore, this was an area that warranted further consideration from both the survey and grounded theory perspectives.

As previously noted, a key limitation of the survey was the cross-sectional rather than longitudinal design which resulted in the finding that there was no conclusive evidence of how beliefs about innate ability might change. By contrast, a positive finding in the grounded theory component of the study was the fluidity of student conceptions in terms of improvement in their ability to study and achieve. Although this could be criticised as being an overly optimistic observation, the belief in an ability to change as a learner appeared to be an important part of coping, academic progression and undergoing transitions throughout the course. One proviso that should be borne in mind was this was not seen just in terms of academic ability and could not be divorced from the effects of wanting to improve as clinical practitioners, that is, to be a good nurse. However, this improvement appeared to be allied to the perception of knowledge structures, and some students saw knowledge as complex with multiple valid viewpoints, but also saw their personal viewpoint as valid and able to exist in their construction of knowledge. A preference was expressed by several students for factual subjects, in particular anatomy and physiology, which was not surprising, but more experienced students also reported they found the study of psycho-social issues stimulating when applied to clinical practice situations.

Transitions came across as major landmarks in the student experience in the interviews. In creating individual identity, these were rites of passage and their successful negotiation were the cause of a re-appraisal of ability and self-development. This occurred for example when there was clicking into place and students expressed feelings that there had been development as a learner.

These changes were also a social change and transitions during a programme of post-registration education were found to follow Van Gennepe's (1960) social transition model (Barton 2007). The model has three distinct phases, separation (or removal from a previous state), transition (a liminal phase where close social relationships with other group members) and an incorporation phase (reintegration with a new state). Barton (2007) identified these stages as 'identity loss', 'learning new practice' and 'returning to practice'. The findings in Barton (2007) around these social transitions mirror the reports by students in this study, which makes Van Gennepe's (1960) model a useful framework for understanding the social processes that occur in pre-registration student cohorts. Understanding the importance of rites of passage from an educational perspective is important because the curriculum will contain set points that act as demarcations during the change process. Also, students will undergo transitions at different times during the programme, such as 'clicking into place, and some sooner than others. Knowledge of these changes can help ease the transition process and maintain the group or cohort cohesiveness and reduce conflict, thus maintaining essential group support for the students. Although outside the remit of this study, this could have implications for student retention and attrition in relation to students who removed from their cohorts because of failure to progress or for personal or social reasons.

From a personal epistemology viewpoint, these findings are consistent with Bendixen's Model of Epistemic Belief Change (2002). During interviews with undergraduates, eight questions were used to explicitly ask participants about knowledge beliefs and what caused them to doubt knowledge and to resolve those doubts in relation to themselves and others. Epistemic doubt was triggered by new learning environments, such as during the move from school to college, and by the new viewpoints of friends and acquaintances, which emphasises the importance of shared learning and the collective support of peers (Kevern & Webb 2004, O'Brien *et al* 2009). Participants reported epistemic doubt was an uncomfortable realization that certain knowledge formerly held as truth was not as certain as they thought (Bendixen 2002), which is consistent with experiencing liminal feelings during troublesome learning (Meyer & Land 2003). Reflection and argument were key to resolving doubt,

but throughout this process as a whole, the role of education was viewed as important and also the social context of the education, the role of peers in challenging personal epistemology and then helping the individual through the resolution process.

Bendixen (2002) considered this model of change consistent with cognitive development as proposed by Piaget (1985), whereby knowledge is developed through accommodation, assimilation and equilibration. New experiences cause disequilibrium, which here underlies the uncomfortable emotional response to challenges about one's personal knowledge. Transitions were reported during the interviews and are an important component of this study because they are about change as a learner and the grounded theory gives some insight into the subjective experiences of this sample of students. A logical progression of belief change could therefore be reasonably expected to occur in some students as they progressed through the course, which could be expressed in the form of the following statement:

- *Student epistemological beliefs would become more sophisticated as they progressed through the pre-registration course.*

The survey results indicated scores on the core epistemological beliefs were not significantly different between the students in CFP and Branch, except for a small significant difference in the innate ability subscale medians, which at first glance appeared counter-intuitive (section 4.18.3). Again, the effect size was small, but this should not mean it should be underestimated or theoretically unimportant (Cohen 1988). This result raised two questions about belief change:

- Did the lack of significant difference in simple knowledge, quick learning and omniscient authority indicate those beliefs were static or stable?
- Did the difference in the innate ability scores indicate a potential change in that belief?

In considering these questions, we have to re-consider the scope and limitations of the survey which was cross-sectional and therefore produced a 'snapshot' view of several

cohorts of students. The difference or lack of difference in the instrument scores did not reflect an actual change in the students' belief about ability as such because the students were only sampled on one occasion. A longitudinal study would be the most desirable design given this finding, but this approach was limited by available resources and other studies such as Kienhues *et al* (2008) have not consistently found changes in beliefs in other university students, which will be discussed further below.

For both questions, the quantitative analysis could provide limited answers, particularly regarding the second. To go back to the literature review, a key criticism by Hofer and Pintrich (1997) of Schommer's (1990) model was that it included the extra construct of innate ability that did not focus on the nature of knowledge or justification for knowing. However, it does add to our understanding of students' perceptions of their ability to learn about learning and improve as they progress through the course, rather than having a genetically preset disposition to learning that is unalterable. Changes in epistemological beliefs have been found in high school students (Schommer *et al* 1997, Cano 2005), but generally are not a feature of findings in research in higher education. In fact, there is growing evidence contrary to expectations that challenges ideas that beliefs may change and become less sophisticated over time in response to learning in university students (Redish *et al* 1998, Maggioni *et al* 2004, Kienhues *et al* 2008). These findings tentatively add support to those studies, but should be treated with caution because of the caveats previously discussed and thus, make it difficult to answer the second of the questions posed above. However, they echo results in Leung *et al* (2008) where there was an unanticipated change in deep and surface learning scores, with an increase in surface approaches as the course progressed.

By contrast to the survey, a key complementary finding during the grounded theory study was that students reported enjoying learning and developing as learners. This engagement with learning featured in several of the interviews and became built into the grounded theory in the categories concerned with transitions and evolving and being comfortable as a knower. This enjoyment of studying and an accompanying sense of loss of time was expressed in terms such as 'time goes really quickly because

I get so into it' (5: 135 – 138) consistent with the psychological state known as flow (Csikszentmihalyi 1990).

Flow is defined as a state of complete absorption and involvement in an activity, possibly purely for its own sake (Csikszentmihalyi 1990). Entering this state usually requires participation in tasks involving high levels of physical or mental skill and concentration, for example as experienced by artists, climbers or chess players. There are certain conditions required for entering this state, although not all will be experienced by every individual during flow states:

- The task requires skills and is one there is a chance of completing.
- Concentration on the task.
- The task has clear goals.
- There is immediate feedback on the task.
- Action and awareness merge and the sense of self as being separate from the task is lost.
- There is a sense of control over actions.
- Self-consciousness disappears, but emerges more strongly after the flow experience is over.
- The sense of time is transformed.

Csikszentmihalyi (1990) defines this state as optimal experience which can be controlled by recognising it can be achieved through setting realistic challenges in the form of tasks which are neither too difficult nor too simple.

There is an immediate resonance in these content of these conditions with the reports of the students in this study and with the literature concerned with deep and surface learning (Marton & Säljö 1976), threshold concepts (Meyer & Land 2003) and transforming as a learner is one of the higher conceptions of learning previously described. Studying may be a route to entering flow states and thus be a source of the 'enjoyment' described by students and it is also something that can be learned. By contrast, episodes of sadness (equating to liminal states) can be a feature of learning

through transformation of potentially negative educational experiences into positive outcomes (Hunter & Csikszentmihalyi 2003). The satisfaction of studying in this form becomes retrospective. In other words, students may experience these episodes of sadness in the struggle with learning, but if they can maintain beliefs in their ability to change as learners and accept that change in other epistemological beliefs may be uncomfortable, there is potential for future benefit. Again this is reflected in the interview accounts, particularly where students saw benefit in terms of social gain and improvement in their ability to support their families.

To conclude this section, the survey results indicated how student nurse personal epistemologies are significantly related to approaches to studying. The grounded theory complemented the quantitative results by exploring further those beliefs concerned with the ability to change as a learner, the rate of knowledge acquisition and seeking approval from authority.

6.5 Proposition 2 - Approaches to studying are descriptors of a whole system and reflect the assessment strategy of a course, student social circumstances and to some extent, clinical placement experience, and are not labels to be applied to individuals.

The grounded theory expanded greatly on the issues surrounding study approaches adopted by students. The strategy adopted was contingent on multiple factors, but the main one was time management and the negotiation of time for study. These were built into the category 'Juggling studying and family needs' which echoes earlier research findings about the competing demands and 'reality shock' of entering nurse education (Kevern & Webb 2004). Nurse students are pulled in different directions by the tripartite influences from the home, the university and the clinical placement environment described earlier. This undoubtedly sets them apart from the majority of university students, with the exception of other vocational courses such as teaching and social work (Flores & Day 2006). Hidden behind the terminology of deep and surface study approaches was the world of the students where the reality of how they studied was a socially negotiated one and not necessarily the one that was preferred. The purpose of the next statement was to explore issues around 'Juggling studying and family needs':

- *Students who were better able to negotiate time to study would express less guilt and issues around role conflict.*

Role conflict was evident from the student interview accounts of how and where studying takes place, the context of studying and relationships with knowledge for example where students talked about feeling torn and partners not understanding how much time they needed for studying. Role conflict has been examined from the perspective of student nurses entering clinical practice and coping with the demands of education and service requirements (Shead 1991), post-registration study (Shiu 1999) and the effects on 'domestic roles' (Kevern & Webb 2004). This state of conflict exists because of the competing demands of the 'greedy institutions' (Coser 1974) of the family, the course of study and work, either paid employment or clinical placement. In particular, family and young children (under thirteen) or dependents

who required a high input of care were unsurprisingly a major issue and predictor of stress for students in terms of studying and assessment preparation (Home 1998, Prymachuk & Richards 2007). There are various aspects to managing these demands, the main one being 'juggling' (Williams *et al* 1991), which emerged during coding in this analysis. A potential negative consequence of juggling is contagion, that is, being preoccupied with one role whilst doing another, which is detrimental to studying (Home 1998).

When the cluster analysis groups were re-examined in relation to the time management and organised studying subscales of the ASSIST (section 4.16), it was apparent there were significant relationships with tendencies to strategic and surface studying. It was worthwhile examining the subscales in more detail, even though the issues were not directly comparable, because the themes in the items could be precursors or contributors to the issues of role conflict in this proposition. These results do not directly establish whether there was any emotional component or guilt involved in time management as indicated by ASSIST. The grounded theory expanded on this result by detailing how time for study is an important factor to students because of the impact it has on family life and the underlying process of negotiation 'Juggling studying and family needs' that is hidden behind the survey results. It would not be a step too far to conceive the students who indicated a strategic approach in the survey were doing so for reasons expressed during the interviews. These are areas for further research and possible re-conceptualisation of ASSIST or a future instrument to move the focus away from one solely on the individual to one which could include elements concerned with managing studying, caring responsibilities and coping with family pressures.

Role conflict resulting from study and negotiating time for study is an important source of stress for student nurses. Family and social influences on stress and coping have been extensively studied at both local and international levels (Prymachuk *et al* 2009, Cuthbertson *et al* 2004, Weitzel & McCahon 2008), in students of other healthcare disciplines (Williams & Decker 2009) and within the broader community of mature students in higher education (Robotham 2008). Their findings resonate with

this analysis with regard to how students perceive the effects of the family on studying and learning, particularly partners and children. A further important source of stress is financial pressure, which features highly as contributors to stress and coping in the literature. What is new is the implication that tensions arise from interactions with the family in relation to issues of student identity or role conflict in addition to the effects of negotiations and transactions over conditions for studying, therefore making these findings pertinent to current concerns about the student experience, student learning, and attrition and retention.

This was also apparent from student accounts of studying, in particular when studying at home when family members were present. No students in the grounded theory sample lived in halls of residence and only one lived away from the parental home, including the younger students. This is one area where there is some variability in the limited reports in the literature, with between 40-65% of students reported as living in external accommodation such as halls of residence in studies carried out in Scotland and Ireland (Jones & Johnston 2000, Rochford *et al* 2009). Living at home sets this sample, and possibly many student nurses, apart from the traditional stereotypes of university students and of student nurses living in nurse accommodation.

Reasons for not living in student accommodation on or near the university site are most likely to be personal and financial, and many schools where nursing programmes run are logically going to be in urban areas where there are concentrations of healthcare facilities (hospitals and clinics). Furthermore, in terms of third mission activities and widening access, living locally to the university sites provides a means for students with families to access to the nursing programme and higher education. Managing study should therefore be recognised as a major potential cause of stress, especially when it is a cause of guilt, which was almost universal. This makes it a possible contributor to attrition in higher education and thus a very relevant area of concern for student recruitment and retention.

Identity as a student was a tacit issue in the interview accounts. Identity in this context is conferred on the individual (and the collective of students) not only by the

institution, but also by the organisation that is the university, formed by the course structure and staff (Jenkins 1996). Furthermore, it is constructed by the family as well who provide a form of consent to the student to adopt that identity. In identifying factors inducing stress, Prymachuk and Richards (2007) regard the status of being a student as the important factor, rather than there being anything especially unique about being a student nurse. They concur it is the 'role-balancing', the juggling, that is required to cope with what are termed the 'hassles of everyday living'. What they neglect to consider is that being a university student is not an everyday living occurrence for most people, and, whilst they take into account the socio-demographic characteristics of students in their statistical model, these were rejected as a factor that was predictive of stress. Also, what is termed 'hassle' may carry much more weight for the individual who is experiencing it at the time.

This language almost belittles the experience and arises from academic discourse about students beginning their academic pursuits. At some point as academics, Prymachuk and Richards (2007) might have made sacrifices or difficult choices affecting their family or social relationships. In addition, what sets a large number of nursing students apart from students who are not in a course of professional training at university is they do not appear to socialise as much due to demands of the course and family life, commuting and fatigue due to the pace of the course or placement (Gibbons *et al* 2008).

Finally, many nursing students may not be from a stereotypical 'traditional' university student background and social class structures within the family could have a far greater bearing on negotiation to study with their family than is immediately apparent (Prymachuk & Richards 2007). It is not social class itself that is an issue, but the bearing it has on whether studying is valued or regarded as a worthwhile pursuit by the family. It is they who then have it in their power to provide conditions for the required and not inconsiderable amount of support the student needs. Social class has an effect on education from the perspective of the wider social environment that student live in at home (i.e. friends, neighbours, relations) and in terms of response from family (Johnson & Robson 1999), although students in this study indicated far

more favourable responses to their roles for possible reasons that have already been outlined and because the registered nurse is now better compensated financially and in terms of professional standing than it has been before.

In terms of stress and coping, gender as an issue in nurse education has been considered as a predictor for attrition (McLaughlin *et al* 2010), particularly for male students. However, in this research certain gender issues were expressed in tacit terms, such as expectations of others to conform to stereotypes around motherhood and childcare requirements. Gender issues were explored more explicitly with regard to relationships with partners, and the rewards they could give or demands they could place on study negotiations. These 'everyday hassles' that arise from juggling roles have complex underlying power structures that are very difficult for the student to negotiate within, particularly those who are established in long-term relationships or family contexts which are founded on legalised partnerships and property. This is congruent with findings in Johnson and Robson (1999). Pressure from multiple sources including the media and experts have raised expectations on mothers to conform to middle-class expectations of 'intensive mothering' whereby they make a positive choice to not work and take on total responsibility for their child's development (Braun *et al* 2008). Paid employment is regarded as part of working-class mothers' identities and those who remain at work risk being labelled inadequate. It is arguable that this is a further stressor and cause of identity and role conflict in nurse students in addition to those already discussed.

6.6 Proposition 3 - Nurse lecturers need to more explicitly consider student nurses' individual approaches to studying and their epistemological beliefs in order to accommodate the diversity of the current student population.

A key observation from the survey was the diversity of the students in terms of the descriptors that could be used to categorise them. There was a wide range of backgrounds in terms of previous occupation and educational qualifications, and a broad age range when compared to studies of students in other higher education disciplines. There were no, or very limited, statistically significant relationships between any of the demographic variables and epistemological beliefs. Whilst this is a 'negative' finding in statistical terms, it was a positive one particularly regarding age and gender. In this study, there were no age-related differences and a Mann-Whitney test to detect gender differences in subscale scores failed to reach statistical significance (although the significance was $p = .057$ for simple knowledge).

There are contradictory findings in the literature, however, concerning age and gender. Weinstock and Cronin (2003) found no differences in epistemological beliefs with age, whereas Walker *et al* (2009) reported older university students were more likely to believe knowledge was uncertain, acquired over time and was integrated (similar to the simple knowledge dimension) using the Epistemological Beliefs Measure (Kardash & Wood 2000). This was in agreement to Schommer (1998). Also, Walker *et al* (2009) reported male students were more likely to hold beliefs that knowledge was absolute, unchanging and transmitted from others. Female students were less likely to believe in innate ability. Also, Cano (2005) found school aged female student were more likely to have more developed epistemological beliefs than males. There is a great deal of physical and mental maturation during the teenage and young adult years and it may be the results from the student nurses who participated in this study reflects how males 'catch up', although this is somewhat speculative given the ratio of females to males in the sample.

It appears the main feature this student sample had in common was that they were registered on a programme of nurse education. Despite the diversity apparent from the

demographic data, a universal finding in the grounded theory study was that students drew considerable strength from each other in the cohort and this mutual support was not gender specific. In Kevern and Webb's (2004) study of mature women entering nurse education this support was seen as highly significant and important because the demands of the preregistration course are difficult for friends and family to understand because of the uniqueness of student nurse experience. Support from compatible friendships in cohorts of students in higher education in general can be just as important as the support from personal tutors and the institution (Wilcox et al 2005). Relationships with personal tutors are highly important for student retention (or attrition) and it is known involvement of students in activities which promote engagement in the classroom including shared learning can promote development of communities (Tinto 1997, 2006). This research adds credence to this and adds to knowledge of sub-communities of students in terms of epistemological beliefs and study approaches.

O'Brien *et al* (2009) reported how students saw the collective support from peers as essential and recognised it filled a gap in provision of support from the institution studied, which students reported was failing to meet their specific needs. Collective support can be classed as informal, but it is an important area for consideration and one which may be eroded by ways of teaching which have an impact upon the amount of time students spend together. This has implications for distance learning or e-learning which may have facilities for collective communication, but can leave students feeling 'disconnected' from peers and tutors (Carnwell *et al* 2001). A key support mechanism is the opportunity to mix with other students in a similar situation and this may be informal, or formalised into induction and an ongoing programme of group meetings with more experienced students (Johnson & Robson 1999).

These issues can be conceptualised from the perspective of social capital and institutional support (Stanton-Salazar 1997). The original foundations of this framework were derived from conceptions of social and cultural capital (Bourdieu 1986), but Stanton-Salazar (1997) re-presents these ideas from the viewpoint of youths from racial minority groups. Social capital was argued to be similar to

economic capital in that it can be accumulated, can produce profits, can be converted into other resources and has the potential to be reproduced into an expanded form. This can be demonstrated through social ties and networks which can produce valuable resources and support. In this study, this support was manifested by the valuable informal and non-institutional systems within the student cohorts and sub-groups that offered practical and emotional benefits to those with membership of the network. Whilst the majority of students in this study were not classifiable as being in a minority racial group, they were student nurses who share some issues in common with minority groups. For example, whilst the issues surrounding identity have already been discussed, there is role conflict evident from the different expectations placed on the students in their home, academic and clinical placement (or 'work' lives, which overlap if the students are employed part-time in care-related environments).

In terms of higher education, student nurses may be somewhat marginalised by lack of opportunity to participate in activities in the wider institution for reasons already described (Gibbons *et al* 2008). In effect, the multiplicity of roles and marginalisation, a propensity to be at risk from stress allied to a diverse range of backgrounds prior to their higher education careers put these students into a minority group. Stanton-Salazar (1997) refers to funds of knowledge that can be offered as forms of institutional support:

- Institutionally sanctioned discourses or social norms of language use and communication;
- Academic task-specific knowledge;
- Organisational/bureaucratic funds of knowledge;
- Network development;
- Technical funds of knowledge e.g. information technology literacy;
- Knowledge of labour and educational markets;
- Problem-solving knowledge.

Of these funds of knowledge Stanton-Salazar (1997) focuses on institutionally sanctioned discourses because knowledge of how to communicate effectively are socially derived. Success in education is argued not just about proficiency at technical skills but is also about knowledge of how to 'decode the system' in order to understand its cultural norms using the organisation's 'identity kit' (p13). This is relevant when we consider student nurses who may have entered the programme via widened access or non-traditional entry to university. Furthermore, students may have to learn about discourse in two sets of institutions. Even if they have come from a background of working in care, such as health care support work, there is a new language and level of discourse to learn and apply.

Whilst there are clearly defined and available institutional support systems, increasing student social and institutional capital should be an aim of pre-registration degree programmes.

6.7 What this Study Adds to Knowledge

This study has focused on pre-registration student nurse personal epistemologies and examined relationships to approaches to studying from an exploratory and descriptive perspective to produce mathematical models. The results from this analysis are set in a social context derived from a grounded theory of personal epistemology and study approaches dependent on multiple influencing factors situated around a core category of juggling family and social commitments.

Student nurse personal epistemologies and study approaches can be described solely in quantitative terms as instrument scores or a simple mathematical model based on the mean and variance. However, these scores provide a snap-shot view emphasising the cross-sectional nature of the sample which highlights lack of information about belief and study approach change in the students. What is more revealing is that there are sub-communities within the sample who demonstrate differences in these scores and traits, yet also show subtle interrelationships dependent on how the data are treated and viewed.

The findings of this study offer greater insight into student nurse personal epistemologies and approaches to studying in context and their potential application in nurse education than has previously been reported in published research. A graphical summary is presented in figure 6.1 which requires explanation as an aid to interpretation.

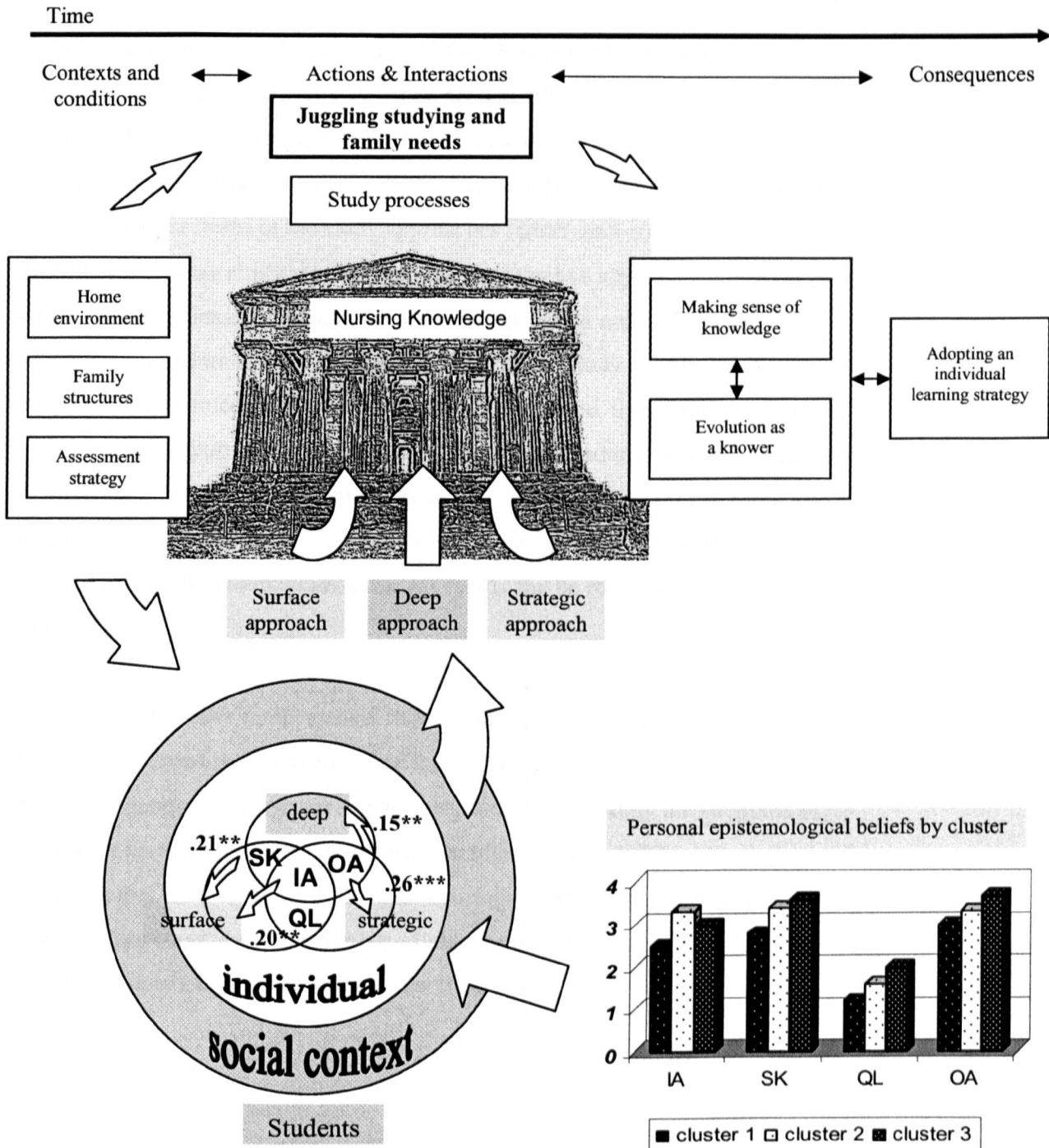


Figure 6.1: Composite diagram of relationships between personal epistemology and approaches to studying.

Key: SK, IA, OA, QL – epistemological beliefs.

Numerical values are regression coefficients and associated significance levels from the path analysis between epistemological beliefs and study approaches in figure 4.10; *** $p < .001$; ** $p < .01$.

The diagram brings together elements of the survey and grounded theory into a composite diagram. There are categories present as well as information from the cluster and regression analyses which can be seen to interact in the lower section representing individuals with epistemological beliefs and study approaches at the core. The intersections of the study approaches (small circles) represent the belief systems with innate ability at the core. This was the one key epistemological belief which was significantly different between clusters and a major determinant in advancement and transitions as a learner. Beliefs and study approaches are socially tempered, represented by the outermost concentric circle. Epistemological beliefs influence study approaches along with context which, in turn, influence pathways through the temple of nursing knowledge. Overarching all is the core category, juggling studying and family needs with time running from left to right, although, as in the grounded theory diagram, these processes can be recursive and repeat themselves.

Rodgers (2010) states mathematical models offer particular advantages over verbal ones; they are readily falsifiable, force theoretical precision and can be more easily studied. Arguably, all these advantages are easily countered by the strengths of qualitative research, or more reasonably complemented by it. This composite model, albeit one that is naïve in its' construction, brings together components from this study that are complementary to give a broader understanding and depth to knowledge of personal epistemology and approaches to studying.

6.8 Recommendations

Several issues have arisen from this research for consideration and inclusion in these recommendations. These will be presented in terms of recommendations at different levels for the individual, the curriculum, the institution and for policy.

6.8.1 Recommendations for Teachers and Students

The findings from this study are useful for teachers and students who wish to enhance their self-awareness and skills for teaching and learning:

- The case for students understanding their own knowledge beliefs has already been made, but is reiterated here in light of changes in the UK higher education system. If students want to ‘learn-clever’, promoting metacognitive self-awareness will be an essential component of assisting student self-appraisal of their learning skills. Ofori (2000) asserts younger students may have less academic self-confidence leading to surface study approaches and low achievement expectations. Activity that promotes the building of confidence and academic skills has to be the focus of teaching activity. This can be seen as a form of increasing social capital.
- Knowledge of one’s own personal epistemological beliefs as a teacher is an important component of professional self-awareness. Furthermore, this knowledge is one component that will contribute to alignment with students in the design of teaching activities and provision of tutorial support and assessment feedback, which is a fundamental part of teaching activity (Young & Paterson 2007). The purpose of higher education is concerned with promoting engagement through development of a coherent and articulate overall view and plan of teaching and learning. This should be followed by exploration of the variation in student perceptions of that planned learning view and its context. The desired result is to integrate awareness of the teachers view with student perceptions and thus develop a relationship in which students can engage with those views (Prosser &

Trigwell 1999). Understanding student learning styles and how they are affected by the educational experiences and the student social context is a key to achieving understanding of student learning and the development of appropriate assessments and tutorial supervision.

- Knowledge of the issues arising from the grounded theory study contributes to evidence in the literature of the importance of pastoral support and helping students to study effectively. This knowledge could drive and support the need for effective and evidence-based interventions to support students who are at risk of or are failing to achieve and are at risk of discontinuation. The teacher/ personal student relationship in nurse education is often a complex, multifactorial one, and pre-empting problems is preferable to acting on issues that have become problems. Any tool or teaching intervention that can help should be considered seriously in light of rising attrition rates (Prymachuk *et al* 2009).
- Lecturers should examine and promote what is enjoyable about studying nursing at higher education levels. Students in this study reported how they found satisfaction in studying and experienced flow (Csikszentmihalyi 1990). Entwistle and McCune (2004) and Coffield *et al* (2004) have identified this lack of emotional engagement, satisfaction or experiencing enjoyment as an issue that is unexplored in the approaches to studying inventories and the conceptual basis of learning styles.
- Tutors will have to 'work-clever' in future to support students and any knowledge about student characteristics and behaviour that can help this process will provide an advantage. As Ofori (2000) points out, the 'at risk' students are often those in their teenage years or early twenties and this group may not recognise they have a need for support interventions until it is too late. Early intervention may be required and knowledge of issues raised in this research could form part of the lecturer's toolkit to assist in this process.

6.8.2 Curriculum Recommendations

This research supports the need for a curriculum that is challenging, that presents stimulating challenges to student epistemologies, such as threshold concepts, through a variety of teaching methods and has clear learning outcomes:

- It has to be one that emphasises problem-solving teaching (Hattie 2010) and self-motivated study rather than the acquisition of information mediated by authority. Threshold concepts could provide the basis of ‘the problems’ and appropriately supported problem-based or problem-solving learning which emphasised self- and team based enquiry and study to provide collective support. This is the route to promoting student engagement with learning and a deep approach to study. These are identified by Hattie (2010) as high impact interventions which meta-analyses demonstrated to have a significant and meaningful effect on student learning and achievement. Furthermore, promoting deep approaches to engagement with studies is a predictor of better learning outcomes and an indication of teaching quality (Gibbs 2010).
- The curriculum should not be so over-structured and directive to cause students to solely focus on the assessed components and abandon everything else (Gibbs 2010). Furthermore, it is suggested explicit goals formulated in response to quality assurance standards have resulted in a reduction in deep orientation to study and confusion over what was expected of students from assessments (Gibbs & Dunbar-Goddet 2007). It can be argued narrow focus on material and over-direction would be in alignment with naïve epistemological beliefs and would not encourage development.
- Formative assessment with structured feedback is also essential to developing students’ abilities and should reinforce their ability to change as learners and to be independent in directing their study. This is the point where clarity of expectations of the student could be achieved through practising performance (Gibbs & Dunbar-Goddet 2007, Gibbs 2010).

6.8.3 Institutional Recommendations

There is a continual drive for widening participation in higher education and the survey demonstrates the diversity of backgrounds of nurse students in terms of the theoretical areas studied in this research as well as in demographic terms. The finding that most of the students were studying whilst living at home in this study have implications for the institution that cannot be ignored.

Student epistemological beliefs influence the way they study, which in turn is mediated by social pressures often arising from juggling family demands and commitments. Student nurses need the support of their colleagues in addition to those formalised support provided by the institution, engagement with which may be regarded as failure. Loss of this collective support, which could be termed student collegiality (Gilmour *et al* 2007), is set to become an actual rather than potential problem if more e-learning and home-based study elements are introduced into the programmes, particularly in light of recommendations in the Browne Review (2010). Any changes made to reduce lecturer and teaching contact-time should be carefully evaluated. Formalising student support from within the cohorts, for example, more peer guides later in the programme and from newly registered students could be very useful, but again, should be evaluated carefully.

A particular point regarding student identity and role conflict arose in relation to clinical placement experience and how this affected study and was influenced by epistemological belief. This was not explored in any depth, but could form the basis of future research.

6.8.4 Policy Recommendations

As has already been alluded to, the changes in higher education funding proposed by the Browne Review (2010) if acted on by government have potential for far-reaching effects. If the changes result in less 'hands-on' teaching and student contact, strategies will be required to maintain essential elements of the education system. The current

drive to raise tuition fees and reduce government support for higher education goes counter to the findings in this study. It is not inconceivable that monies raised by fees increases will be siphoned into research and infrastructure projects to raise the profile of institutions. If this is the case, it has to be asked where the funding will come from to support teaching. Therefore, action should be taken to preserve teaching and recognise its benefit and essential role in terms of teaching students, retention and promotion of collegial communities.

6.8.5 Recommendations for Professional Nursing

In addition to the social construction of student identity by the university and the family, the effect of clinical practice is arguably an important influence.

- Student nurses are endowed with both student and 'nurse' status, and all the implications and connotations of those roles, and this is what sets them apart from other non-vocational higher education students. Their 'studenthood' may be potentially threatened in the placement area where they may be regarded just as 'a pair of hands' or their student status may be equated with being not competent, possibly by both patients and staff. 'Belonginess' is an important part of the student experience from day one on placement and legitimisation of the student role is essential to teaching and learning in the clinical environment (Levett-Jones 2009). One intervention could be to flag this area as important include managing this aspect of student behaviour in mentor courses and updates.
- The much-discussed theory practice gap (Baxter 2007) is presented in a different light here in that the way students' approach their studies may be threatened, which is consistent with previous studies of the impact of ward culture (Pearcey & Elliott 2004). This is because of negative socialisation and conflict over their student status and identity from the profession they are aspiring to enter. Although there were no outright reports of nurses 'eating their young' in the interviews, the effect that placements have on attitudes to studying should be acknowledged,

especially around the issue of studying for a degree and identity as an undergraduate (Daiski 2004).

- The grounded theory indicated the effect on clinical placements on students which is regarded as vital to the success of the programme (Pearcey & Elliott 2004). Students often reported they wanted to perform well in practice, but were used as a pair of hands to do the labouring work required to provide fundamental nursing care. Not surprisingly, this can lead to identity and role conflict.
- Arguably, this has an impact on studying and this could be extended to personal epistemology. If students are not exposed to situations where complex problem solving skills need to be exercised, then those skills will not develop. It can reasonably be hypothesised that if a student is not being utilised to the best of their ability in practice then there will be an effect on beliefs related to innate ability and engagement with course material whilst on placement. However, this has to be balanced by the consideration that the placement is the reason why many of the students are on the course. The students predominantly want to be nurses and it is one place where they can demonstrate skills and get immediate feedback from patients, peers and mentors.

6.8.6 Methodological Recommendations

The intention of the mixed methods design was to gain greater depth of understanding of the phenomena of personal epistemology and how these related to study approaches (Morse 2003, Tashakkorri & Teddlie 2003). The design combined quantitative and qualitative approaches in one study to provide exploration of the lived experiences of the students and how they expressed their epistemologies. The purpose of the design was complementarity and expansion. The underlying rationale was to provide a wider picture than solely a survey approach or qualitative approach could provide which was in part achieved, but there were issues arising from the methodology and methods used:

- Clearer procedures are needed to guide the integration process in a systematic and robust way, for example a decision tree to facilitate comparison and contrasting of complementary or divergent findings, areas where one dataset expands on another and which areas promote initiation of new research questions.
- Guidelines for combining and reporting quantitative and qualitative findings together in a format that does not involve quantising or qualitisng. This may need relaxed or revised reporting requirements, for example revised APA guidelines, and an acceptance and development of dynamic modes of visual data presentation.
- Need for revised instruments for quantitative data collection to include elements from the grounded theory, such as influences of care roles. However, this is a sensitive area for research and raises a number of ethical issues, but could contribute to knowledge because it is an under-researched area in nurse education.
- Demographic diversity led to issues of variation in this sample in the quantitative analysis and results. That heterogeneity is a key characteristic of nurse students and may indicate the need for novel and more robust quantitative and qualitative data collection and processing techniques. This could include, for example, the development and adoption more robust multivariate analysis procedures such as ESEM for mainstream research use, i.e. through integration with commonly used data processing software. In terms of grounded theory, a major issue is theoretical sampling and more guidance for the development of this technique with diverse populations is needed.
- Questionnaire administration through electronic web administration and incentives could be a route to improve data collection and remove potential effects of researcher influence. However, this would need shorter versions of the ASSIST to ensure good completion rates.

6.8.7 Recommendations for Future Research

This thesis emphasises the difficulties inherent in studying areas of educational psychology and learning styles which lack well-defined theoretical bases (Coffield *et al* 2004). One potential avenue to overcome the problems of focusing on personal epistemology through questionnaires or interviews espoused by Niessen's (2007) approach uses an enactivist epistemological perspective employing evaluation methods. This uses thick descriptive accounts and observation to promote understanding of the complexity inherent in teaching, as opposed to regarding it as a complicated mechanism. Personal epistemology is regarded as co-constructed and thus becomes emergent epistemology and is one element of the complex phenomenon of teaching. Alternately, Greene *et al* (2008) propose a model that return personal epistemology back to its philosophical roots, yet retains elements of an independent beliefs system within a developmental framework utilising quantitative methods currently under development.

Future research in this field with student nurses should consider the limitations of this study:

- An expanded longitudinal sample from a variety of data collection sites would enable more accurate statistical modelling and generalisability of quantitative results. However, there is limited information concerning test-retest reliability of the EBI (Schraw *et al* 2002). A larger dataset could provide more information about confounding variables and clarify questions where there was insufficient data in this study. One example of an area for development would be the expansion of the regression model which is based on the total dataset into a model which reflects the nature and composition of the clusters. This could provide more detail about the influence of personal epistemology on learning styles.
- Future questions could focus on the possible change in student beliefs about innate ability. Changes in beliefs remain an area of interest in personal epistemology research. Explanation of why these changes occur is important to ensure students are exposed to teaching experiences that promote learning rather than cause loss of motivation and negative belief change.

- Further qualitative research would be enhanced by attention to the social processes that occur and influence our students studying. This research has touched on how social processes influence student nurses, but of greater interest will be research that investigates issues around ethnicity, gender and socio-economic influences. Different methodologies could frame findings more effectively for nurse education research, such as a feminist approach in light of findings concerning the pressure on students from male partners.

6.9 Conclusion

The findings from this study of student nurse personal epistemologies and study approaches are relevant to contemporary nurse education at several levels. From an international perspective, there is renewed interest and debate about related areas including the cognitive abilities of nurses in relation to decision making (Fero *et al* 2009, Wangenstein *et al* 2010), student and registered nurse attrition rates (Pryjmachuk *et al* 2009, Urwin *et al* 2010) and stress and coping in student nurses (Galbraith & Brown 2010). In terms of preregistration education programmes in the UK, there is renewed focus on the content of curricula and the academic level of nurse qualifications at a time of increasing pressure to widen participation and reduce attrition student rates (NMC 2010, Taylor *et al* 2010). All of this is happening in an arena where healthcare and nursing is increasingly publicly scrutinised and has become an issue for political manifestoes in the UK and US (DH 2010, Schultz 2011).

From the perspective of higher education in the UK, this study is relevant because of the interest in the quality of teaching and learning and the emphasis on undergraduate teaching in the National Student Survey (Williams & Kane 2008, Gibbs 2010). This is occurring during a time of contraction in student funding and teaching posts. The findings of this study contribute to knowledge about student learning and factors that affect their student experience. These include social factors related to student diversity that may have been taken for granted previously, but which have become increasingly important for consideration during curriculum development and course delivery.

The strengths and limitations of a mixed methods approach have enabled identification of key findings and also areas that could form the basis of questions for further investigation. Integrating results from both the survey and grounded theory studies illuminated student nurse personal epistemologies and how these influenced approaches to studying from different perspectives. It was possible to describe personal epistemologies in terms of the inferences that could be drawn from the numerical survey scores, but the grounded theory added contextual and processual information. The relationships between students and their programme of study, their

beliefs, study approaches and the social forces are dynamic and contextual and difficult to capture with existing quantitative tools. This reflects current dialogues in personal epistemology literature about the form of the constructs that make up knowledge beliefs, how they are influenced by cultural factors and methodological questions about how they should be investigated (Niessen 2007, Greene et al 2008, Hofer 2010).

Approaches to studying and deep and surface learning are well-used concepts which can help understanding of how students approach learning tasks. The finding that the majority of students indicated deep or strategic approaches was consistent with previous research and an indicator of the demands of the course, particularly the assessment strategy. This is an important area for consideration of future programmes of study and one that should be given priority. Nurse education is approaching an era of change and turbulence in terms of programme design, new curricula and all graduate entry throughout the UK, coupled with wider changes in higher education student funding. Examination of any influences that affect student learning is therefore warranted and worthwhile if the aim is to improve the experience of student nurses and promote quality teaching.

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Appendix 1: Research ethics committee letter.

**Ysgol Nyrsio, Bydwreigiaeth
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OUR REF: RWRIJRW

Mr John Alcock, Lecturer in Nursing,
The School of Nursing, Midwifery & Health Studies
Fron Heulog
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Dear Mr Alcock

Re: School of Nursing, Midwifery and Health Studies Research Ethics Committee

Research Proposal – A study of the beliefs about knowledge and approaches to teaching and learning of pre-registration student nurse and nurse lecturers in relation to the biosciences

Further to the submission of your above proposal to The School of Nursing, Midwifery and Health Studies Research Ethics Committee on Tuesday 26th July 2005.

Firstly, may I thank you on behalf of the Committee for attending on the day to discuss your proposal and respond to the queries raised by Committee members – this was most helpful.

Having discussed your proposal at some length, and given careful consideration to all the salient issues, I am pleased to inform you that the Committee was able to reach a decision.

The School of Nursing, Midwifery and Health Studies Research Ethics Committee would be prepared to grant ethical approval for your above proposal, subject to the following conditions being met:

- 1) The Committee noted your comment that you remained somewhat unsure of the best method of administration of the questionnaires to the participants. It was agreed that it would be prudent to give further consideration to any possible perception of coercion and to select a method of administration most likely to anticipate such concerns in the interest of both the participants and the researcher.
- 2) On page 3, (A9) it would be appropriate to amend the statement in the first paragraph "*There has been no nursing research ...*" to read "*There has been no nursing research to my knowledge ...*".

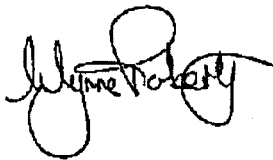
The above conditions have been sought by the Committee in accordance with the execution of it's terms of reference.

A copy of your submission revised in accordance with the Committee's above requirements should be submitted to the Committee as soon as possible. Once this has been witnessed by The Chair (as a formality for Committee records) ***ethical approval to proceed will then become effective and confirmation of formal approval will be issued.***

Please note that ethical approval from The SNMHS REC does not convey automatic authority to proceed with your study. ***You are formally advised that it is essential to confirm with the relevant administrators whether you are required to submit your proposal to any other Ethics Committee(s) -for example, Local Research Ethics Committees – prior to conducting your research.***

Should you need clarification in any respect concerning the Committee's approval, please do not hesitate to contact me.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Wynne Roberts', with a stylized, cursive script.

**Reverend Wynne Roberts
CHAIR
School of Nursing, Midwifery & Health Studies Research Ethics Committee**

Appendix 2: Study information sheet and consent form



A study of the epistemological beliefs of pre-registration nursing students

Dear Colleague/Student,

I have written this letter to invite you to take part in a research study. Before you decide to participate it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

What is this about?

I am undertaking a research study for my PhD to investigate student and lecturer beliefs about the biosciences (such as anatomy and physiology) and how those beliefs affect teaching and learning of these subjects in the pre-registration programme.

Who can take part?

I am aiming to recruit participants from all cohorts and lecturers in the School of Healthcare Sciences, Wrexham and Bangor, and follow cohorts from 2/05 throughout their pre-registration training.

How will it be done?

The intention of the research is to explore beliefs about bioscience knowledge and learning through a series of educational assessment questionnaires, which should take approximately 20 minutes to complete. I would like to request some general demographic data such as age range (e.g. 20-25), previous qualifications (GCSE, NVQ, Degree) and general previous employment background (e.g. health care work in hospital). This will not be in enough detail to permit identification, but is important to the context of the study and to test some current ideas in education. The questionnaires will be followed up a few weeks later by interviews of about 30 minutes to put the results in context. If you agree to participate further, you will be contacted regarding interview and as part of this process, a consent form will need to be signed by yourself and the researcher. The invitation for interview will require you

to be identified by name and cohort so that you can be contacted by means of your choice, e.g. email or cohort contact point (corral). After this, you will be invited to a focus group workshop where results will be presented and you can be involved in refining research findings with lunch provided. The aim of this process is to present results to everybody and promote involvement by participants to gain more meaningful findings (increase validity and reliability).

Will my information be confidential?

At all times, any personal data will be closely protected under lock and key in a safe place or encrypted on a university computer. You may notice a code number is apparent on the questionnaire. This will be used to identify you should you choose to be called for interview. All interviews will be recorded and transcribed by me or the research secretary and any identifying characteristics will be removed to preserve your anonymity. Data will be destroyed on completion of the project in accordance with Bangor University guidelines on data protection.

What use is this information to me and others?

Exploration of approaches to learning and beliefs about knowledge of participants will help us to gain better understanding of student needs and aid design of the curriculum and student-centred learning. By participating you might learn something about your own learning needs and research, but however much you are involved, all information will be invaluable.

What happens if I do not want to take part?

It is up to you to decide whether or not to take part in this research. If you do decide to take part in the interview and focus group workshop you can keep this information sheet and I would ask you to sign the consent form included with this letter. If you decide to take part you are still free to withdraw at any time without giving a reason.

Any questions?

At this point, if you have any other questions or any of the above is unclear, please ask me – you can phone on _____ or email hss807@bangor.ac.uk.

Alternatively, you can contact my supervisor Professor Jo Rycroft-Malone or co-supervisor, Dr M. Godwin, for advice or support regarding this project.

Many thanks,



John Alcock.

A study of the epistemological beliefs of pre-registration nursing students.

Participant consent form for interview

Researcher: John Alcock

I confirm I have read the research information sheet for the above study and have had time and the opportunity to discuss and clarify concerns.

I agree to participate in the above study.

I confirm that my participation is voluntary and I understand I am free to withdraw at any time. If I withdraw after interview my data will be destroyed.

If you agree with the above please sign below:

Name of participant.....

Signature.....

Date.....

Please indicate preferred method of contact:

Cohort corral.....Y/N... Cohort:.....

Email.....Y/N... Email:.....

Staff pigeonhole... Y/N

Name of researcher.....

Signature.....

Date.....

Appendix 3: Epistemic Beliefs Inventory (Schraw, Bendixen & Dunkle 2002).

Epistemic Beliefs Inventory

Please work through the comments, giving your **immediate** response. It is also very important that you answer all the questions; please check you have.

5 means agree 4 = agree somewhat 2 = disagree somewhat 1 = disagree

Try not to use 3 = unsure, unless you really have to, or if it cannot apply to you or your course.

1. Most things worth knowing are easy to understand.	5	4	3	2	1
2. What is true is a matter of opinion.	5	4	3	2	1
3. Students who learn things quickly are the most successful.	5	4	3	2	1
4. People should always obey the law.	5	4	3	2	1
5. People's intellectual potential is fixed at birth.	5	4	3	2	1
6. Absolute moral truth does not exist.	5	4	3	2	1
7. Parents should teach their children all there is to know about life.	5	4	3	2	1
8. Really clever students don't have to work as hard to do well in school.	5	4	3	2	1
9. If a person tries too hard to understand a problem, they will most likely end up being confused.	5	4	3	2	1
10. Too many theories just complicate things.	5	4	3	2	1
11. The best ideas are often the most simple.	5	4	3	2	1
12. Lecturers should focus on facts instead of theories.	5	4	3	2	1
13. Some people are born with special gifts and talents.	5	4	3	2	1
14. How well you do in school depends on how clever you are.	5	4	3	2	1
15. If you don't learn something quickly, you won't ever learn it.	5	4	3	2	1
16. Some people just have a knack for learning and others don't.	5	4	3	2	1
17. Things are simpler than most lecturers would have you believe.	5	4	3	2	1
18. If two people are arguing about something, at least one of them must be wrong.	5	4	3	2	1
19. Children should be allowed to question their parents' authority.	5	4	3	2	1
20. If you haven't understood a chapter the first time through, going back over it won't help.	5	4	3	2	1
21. Science is easy to understand because it contains so many facts.	5	4	3	2	1
22. The more you know about a topic, the more there is to know.	5	4	3	2	1
23. What is true today will be true tomorrow.	5	4	3	2	1
24. Clever people are born that way.	5	4	3	2	1
25. When someone in authority tells me what to do, I usually do it.	5	4	3	2	1
26. People shouldn't question authority.	5	4	3	2	1
27. Working on a problem with no quick solution is a waste of time.	5	4	3	2	1
28. Sometimes there are no right answers to life's big problems.	5	4	3	2	1

Appendix 4: Student demographic questionnaire.

Demographic questionnaire

Could you please tick the box in each section most appropriate for yourself. This sheet will be destroyed as soon as the data is processed.

Age:

- 20 years or younger
- 21-25 years
- 26-30 years
- 31-35 years
- 35 years or more

Gender:

- Female
- Male

Occupation before course:

- Health care assistant – hospital health care support worker, homecarer, childcare or residential worker.
- Manual work, plant or machine operator, building work, clerical, secretarial or admin work, sales occupations.
- Manager or administrator, professional occupation, engineer, teacher.
- No previous occupation or full time parent.

Educational background:

- 'O' level/GCSE

- Can you please state which science subjects you passed?

- 'A' or 'AS' level

- Can you please state which science subjects you passed?

- Access course
- NVQ
- Ba/Arts degree

- Subject

- BSc/Science degree

- Subject

Appendix 5: Approaches and Study Skills Inventory for Students (Tait *et al* 1998).

This questionnaire has been designed to allow you to describe, in a systematic way, how you go about learning and studying biosciences. The technique involves asking you a substantial number of questions which overlap to some extent to provide good overall coverage of different ways of studying. Most of the items are based on comments made by other students. Please respond truthfully, so that your answers will accurately describe your actual ways of studying biosciences, and work your way through the questionnaire quite quickly.

A. What is learning?

When you think about the term 'LEARNING', what does it mean to you?

Consider each of these statements carefully, and rate them in terms of how close they are to your own way of thinking about it.

	<i>Very close</i>	<i>Quite close</i>	<i>Not close</i>	<i>Rather different</i>	<i>Very different</i>
a. Making sure you remember things well.	5	4	3	2	1
b. Developing as a person.	5	4	3	2	1
c. Building up knowledge by acquiring facts and	5	4	3	2	1
d. Being able to use the information you've acquired.	5	4	3	2	1
e. Understanding new material for yourself.	5	4	3	2	1
f. Seeing things in a different and more meaningful way.	5	4	3	2	1

B. Approaches to studying

5 means agree 4 = agree somewhat 2 = disagree somewhat 1 = disagree

Try not to use 3 = unsure, unless you really have to, or if it cannot apply to you or your course.

1. I manage to find conditions for studying which allow me to get on with my work easily.	1	2	3	4	5
2. When working on an assignment, I'm keeping in mind how best to impress the marker.	1	2	3	4	5
3. Often I find myself wondering whether the work I am doing here is really worthwhile.	1	2	3	4	5
4. I usually set out to understand for myself the meaning of what we have to learn.	1	2	3	4	5
5. I organise my study time carefully to make the best use of it.	1	2	3	4	5
6. I find I have to concentrate on just memorising a good deal of what I have to learn.	1	2	3	4	5
7. I go over the work I've done carefully to check the reasoning and that it makes sense.	1	2	3	4	5
8. Often I feel I'm drowning in the sheer amount of material we're having to cope with.	1	2	3	4	5
9. I look at the evidence carefully and try to reach my own conclusion about what I'm studying.	1	2	3	4	5
10. It's important for me to feel that I'm doing as well as I really can on the courses here.	1	2	3	4	5
11. I try to relate ideas I come across to those in other topics or other courses whenever possible.	1	2	3	4	5
12. I tend to read very little beyond what is actually required to pass.	1	2	3	4	5

13. Regularly I find myself thinking about ideas from lectures when I'm doing other things.	1	2	3	4	5
14. I think I'm quite systematic and organised when it comes to revising for exams.	1	2	3	4	5
15. I look carefully at tutors' comments on course work to see how to get higher marks next time.	1	2	3	4	5
16. There's not much of the work here that I find interesting or relevant.	1	2	3	4	5
17. When I read an article or book, I try to find out for myself exactly what the author means.	1	2	3	4	5
18. I'm pretty good at getting down to work whenever I need to.	1	2	3	4	5
19. Much of what I'm studying makes little sense: it's like unrelated bits and pieces.	1	2	3	4	5
20. I think about what I want to get out of this course to keep my studying well focused.	1	2	3	4	5
21. When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.	1	2	3	4	5
22. I often worry about whether I'll ever be able to cope with the work properly.	1	2	3	4	5
23. Often I find myself questioning things I hear in lectures or read in books.	1	2	3	4	5
24. I feel that I'm getting on well, and this helps me put more effort into the work.	1	2	3	4	5
25. I concentrate on learning just those bits of information I have to know to pass.	1	2	3	4	5
26. I find that studying academic topics can be quite exciting at times.	1	2	3	4	5
27. I'm good at following up some of the reading suggested by lecturers or tutors.	1	2	3	4	5
28. I keep in mind who is going to mark an assignment and what they're likely to be looking for.	1	2	3	4	5
29. When I look back, I sometimes wonder why I ever decided to come here.	1	2	3	4	5
30. When I am reading, I stop from time to time to reflect on what I am trying to learn from it	1	2	3	4	5
31. I work steadily through the term or semester, rather than leave it all until the last minute.	1	2	3	4	5
32. I'm not really sure what's important in lectures so I try to get down all I can.	1	2	3	4	5
33. Ideas in course books or articles often set me off on long chains of thought of my own.	1	2	3	4	5
34. Before starting work on an assignment or exam question, I think first how best to tackle it	1	2	3	4	5
35. I often seem to panic if I get behind with my work.	1	2	3	4	5
36. When I read, I examine the details carefully to see how they fit in with what's being said.	1	2	3	4	5
37. I put a lot of effort into studying because I'm determined to do well.	1	2	3	4	5
38. I gear my studying closely to just what seems to be required for assignments and exams.	1	2	3	4	5
39. Some of the ideas I come across on the course I find really gripping.	1	2	3	4	5
40. I usually plan out my week's work in advance, either on paper or in my head.	1	2	3	4	5

41. I keep an eye open for what lecturers seem to think is important and concentrate on that.	1	2	3	4	5
42. I'm not really interested in this course, but I have to take it for other reasons.	1	2	3	4	5
43. Before tackling a problem or assignment, I first try to work out what lies behind it.	1	2	3	4	5
44. I generally make good use of my time during the day.	1	2	3	4	5
45. I often have trouble in making sense of the things I have to remember.	1	2	3	4	5
46. I like to play around with ideas of my own even if they don't get me very far.	1	2	3	4	5
47. When I finish a piece of work, I check it through to see if it really meets the requirements.	1	2	3	4	5
48. Often I lie awake worrying about work I think I won't be able to do	1	2	3	4	5
49. It's important for me to be able to follow the argument, or to see the reason behind things.	1	2	3	4	5
50. I don't find it at all difficult to motivate myself.	1	2	3	4	5
51. I like to be told precisely what to do in essays or other assignments.	1	2	3	4	5
52. I sometimes get hooked on academic topics and feel I would like to keep on studying them.	1	2	3	4	5

C. Preferences for different types of course and teaching

5 means definitely like 4 = like to some extent 2 = dislike to some extent 1 = definitely dislike

Try not to use 3 = unsure, unless you really have to, or if it cannot apply to you or your course.

53. Lecturers who tell us exactly what to put down in our notes.	1	2	3	4	5
54. Lecturers who encourage us to think for ourselves and show us how they themselves think.	1	2	3	4	5
55. Exams which allow me to show that I've thought about the course material for myself.	1	2	3	4	5
56. Exams or tests which need only the material provided in our lecture notes.	1	2	3	4	5
57. Courses in which it's made very clear just which books we have to read.	1	2	3	4	5
58. Courses where we're encouraged to read around the subject a lot for ourselves.	1	2	3	4	5
59. Books which challenge you and provide explanations which go beyond the lectures.	1	2	3	4	5
60. Books which give you definite facts and information which can easily be learned	1	2	3	4	5

Finally, how well do you think you have been doing in your assessed work overall, so far?

Please rate yourself objectively, based on the grades you have been obtaining

Very well	Quite Well	About average	Not so well	Rather badly
9	8	7	6	5
				4
				3
				2
				1

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

Appendix 6: Epistemic Beliefs Inventory Pilot Study

Administration

The administration of the questionnaire was as described in the methodology and time frame was January 2006 until April 2007.

The following procedure in box 1 was followed to prepare the data and carry out exploratory factor analysis.

Box 1: Exploratory factor analysis procedures after (Tabachnick and Fidell 2001).

Step 1: Explore data limitations and ensure prerequisites for procedure are met:

- Adequate sample size
- Data screening - outliers among cases, variables and missing data
- Factorability of the correlation (R) matrix
- Normality and linearity of variables
- Multicollinearity and singularity

Step 2: Major analyses:

- Consider number of factors to extract
- Type of extraction and rotation of factor matrix
- Nature or meaning of factors – ‘factor labels’
- Substantive importance of factors

Step 3: Additional analyses:

- Calculation of factor scores
- Distinguishability and simplicity of factors
- Internal consistency of factors
- Outlying cases among the factors

Sample Characteristics

The sample participants were as previously defined in the methodology and methods. The demographics questionnaire was not given to all participants due to an administrative error on the part of the researcher, therefore, the only complete data collected and reported here are the participant cohort and frequency of responses (table 1). Data about respondent age, gender and background were not collected, but

from existing cohort information, the proportion of male respondents can reasonably be assumed to be less than 10% of the sample total. In total, the sample was comprised of 141 CFP (49%) and 145 (51%) branch programme students. Of 430 students in total that could potentially participate, 286 returned the questionnaire which represented a 67% response rate.

Table 1: Summary of participants in the pilot study by cohort.

	Frequency of response	Percentage	Cohort size
2.03 S1 AD	7	2.4	37
2.03 S1 MH	18	6.3	18
2.03 S1 CB	3	1.0	16
1.04 S1 AD	31	10.8	40
2.04 S1 AD	10	3.5	29
2.04 S1 MH	13	4.5	18
1.05 S1 AD	17	5.9	35
2.05 S1 AD	3	1.0	31
1.06 S1 CFP	41	14.3	44
2.06 S1 CFP	49	17.1	57
1.07 S1 CFP	46	16.1	49
1.07 S2 CFP	48	16.8	56
Total	286	100	430

Key: S1 – site one, S2 – site two, CFP – common foundation programme, AD – adult branch, MH – mental health branch, CB – child branch.

Data Screening and Preparation

Twenty five (9%) of the 286 pilot questionnaires returned had missing values (table 2), which exceeded the 5% threshold recommended by Tabachnick and Fidell (2001). This indicated an examination of the data for any non-random pattern of missingness. No individual item had greater than 5% of values missing provided an overview of items where there were missing values. For items apart from question 6, it appeared the missing data were missing completely at random or MCAR (Enders & Bandalos 2001), that is, the probability of response being missing was independent of the variables. The highest number of missing values was six (2%) for item six 'Absolute moral truth does not exist' which, although low, raised questions about the wording and validity of that item in the EBI which will be addressed later in this analysis.

Table 2: Summary of missing values from the EBI pilot study data.

Item	N		Missing		Item	N		Missing	
	Count	Count	Percentage	Count		Count	Percentage		
q01	286	0	.0	q15	286	0	.0		
q02	284	2	.7	q16	284	2	.7		
q03	285	1	.3	q17	285	1	.3		
q04	285	1	.3	q18	286	0	.0		
q05	286	0	.0	q19	285	1	.3		
q06	280	6	2.1	q20	286	0	.0		
q07	285	1	.3	q21	284	2	.7		
q08	284	2	.7	q22	285	1	.3		
q09	286	0	.0	q23	285	1	.3		
q10	285	1	.3	q24	284	2	.7		
q11	286	0	.0	q25	284	2	.7		
q12	284	2	.7	q26	285	1	.3		
q13	286	0	.0	q27	284	2	.7		
q14	285	1	.3	q28	285	1	.3		

Missing data entries on the completed questionnaires were examined in detail and three types of completion errors were apparent (figure 1). Straightforward omissions during completion were to be expected (image 1), but the total number of these errors was initially surprising. The error in image 2 was more complex and occurred where the participant appeared to change their mind about their initial choice and deleted entries. Image 3 was restricted to one sole example, and appears to have occurred because the tails of the ticks encroached into other item response areas. This could be a result of the larger response area for item 9. All these types of errors were considered during revision of the EBI after this pilot study and more attention was paid to layout, appearance, instructions and the provision of clearer response areas. The SPSS descriptive statistics output also indicated a data entry error where value on the data table entered as '12' which was cross-checked against the paper originals and the correct value was substituted.

Image 1 – Simple omission (x written during data entry and analysis, not by participant).

1. Most things worth knowing are easy to understand.	5	4	3	2	①	
2. What is true is a matter of opinion.	5	4	3	②	1	
3. Students who learn things quickly are the most successful.	5	4	3	2	①	
4. People should always obey the law.	5	4	3	②	1	
5. People's intellectual potential is fixed at birth.	5	4	3	②	1	
6. Absolute moral truth does not exist.	5	4	3	②	1	
7. Parents should teach their children all there is to know about life.	x	5	4	3	2	1
8. Really clever students don't have to work as hard to do well in school.	5	④	3	2	1	
9. If a person tries too hard to understand a problem, they will most likely end up being confused.	5	④	3	2	1	

Image 2 – Omission and deletions.

10. Too many theories just complicate things.	5	4	3	②	1
11. The best ideas are often the most simple.	5	4	3	②	1
12. Instructors should focus on facts instead of theories.	5	4	3	2	1
13. Some people are born with special gifts and talents.	5	④	3	②	1
14. How well you do in school depends on how clever you are.	5	④	3	②	1
15. If you don't learn something quickly, you won't ever learn it.	5	4	3	②	1

Image 3 – Omission through ticking as opposed to circling choice on the Likert scale.

8. Really clever students don't have to work as hard to do well in school.	5	4	3	2	1
9. If a person tries too hard to understand a problem, they will most likely end up being confused.	5	4	3	2	1
10. Too many theories just complicate things.	5	4	3	2	1
11. The best ideas are often the most simple.	5	4	3	2	1
12. Lecturers should focus on facts instead of theories.	5	4	3	2	1
13. Some people are born with special gifts and talents.	5	4	3	2	1

Figure 1: Scanned copies of original questionnaires demonstrating types of completion errors.

Skew and kurtosis were assessed by visually examining histograms for each item and using the 'normtest' SPSS syntax (De Carlo 1997) with the results in table 3. The data were mainly non-normal as a result of the Likert scales.

In the last stage of screening and preparation for analysis, the negatively worded items 6 and 19 (6 - 'Absolute moral truth does not exist' and 19 - 'What is true today will be true tomorrow') were reverse keyed using the recode into same variables command. Cronbach's Alpha for the 28 items was 0.67. No individual item stood out as requiring attention, so all items were retained. The corrected item-total correlation values below 0.3 were low, although in a large sample size this criterion can be relaxed (Field 2005).

The Kaiser-Meyer-Olkin (KMO) result was 0.68 which provided a further measure of reliability and suitability for factor analysis. Tabachnick and Fidell (2001) recommend a KMO greater than 0.6 for 'good' factor analysis. Bartlett's measure of sphericity result was highly significant [$\chi^2(378, N = 286) = 1209.3, p = < .001$] and therefore, using this criterion, factor analysis was appropriate.

Table 3: Normtest output for skew and kurtosis, EBI 28 item pilot.

Measures and tests of skew:

	z	p-value
Item 1	.3787	.7049
Item 2	-2.9810	.0029
Item 3	5.6605	.0000
Item 4	-6.6026	.0000
Item 5	6.0459	.0000
Item 6	-.0280	.9777
Item 7	-1.4621	.1437
Item 8	2.0356	.0418
Item 9	-1.7408	.0817
Item 10	-3.5473	.0004
Item 11	-6.2291	.0000
Item 12	1.0559	.2910
Item 13	-7.3717	.0000
Item 14	3.5983	.0003
Item 15	8.5722	.0000
Item 16	-2.1528	.0313
Item 17	.5510	.5817
Item 18	6.7338	.0000
Item 19	2.7174	.0066
Item 20	10.3009	.0000
Item 21	6.1347	.0000
Item 22	-6.2092	.0000
Item 23	6.1815	.0000
Item 24	4.5530	.0000
Item 25	-4.9850	.0000
Item 26	5.0197	.0000
Item 27	7.3359	.0000
Item 28	-7.5925	.0000

Measures and tests of kurtosis:

	z	p-value
Item 1	-25.0902	.0000
Item 2	-7.3031	.0000
Item 3	.2487	.8036
Item 4	2.4493	.0143
Item 5	1.1491	.2505
Item 6	-9.2001	.0000
Item 7	-15.4335	.0000
Item 8	-17.3916	.0000
Item 9	-12.0829	.0000
Item 10	-4.7009	.0000
Item 11	2.0480	.0406
Item 12	-9.3326	.0000
Item 13	3.4998	.0005
Item 14	-4.7402	.0000
Item 15	5.8684	.0000
Item 16	-11.6679	.0000
Item 17	-13.0763	.0000
Item 18	1.9131	.0557
Item 19	-8.0406	.0000
Item 20	6.9498	.0000
Item 21	1.5101	.1310
Item 22	2.0046	.0450
Item 23	1.2350	.2168
Item 24	-2.2978	.0216
Item 25	-1.2052	.2281
Item 26	-.5622	.5739
Item 27	3.7128	.0002
Item 28	2.9216	.0035

Factor Analysis

The mean communality was 0.597 and the range was 0.479 to 0.748, thus the communalities were wide. The initial factor analysis solution provided ten factors greater than one explaining 59.7% of variance. This fell within the quick estimate rule of Tabachnick and Fidell (2001) that the estimated number of factors with eigenvalues greater than one is the number of items (28) divided by 3 or 5, which would result in between 4 and 9-10 factors when there are 40 or fewer variables and the sample size is large. Analyses with different rotations after extracting five, six and seven factors enabled identification of the simplest or preferred solution.

The scree plot (figure 2) was reasonably straightforward to interpret with ten eigenvalues greater than one, but there were two potential points of inflection, one at factor five and a minor point at factor seven.

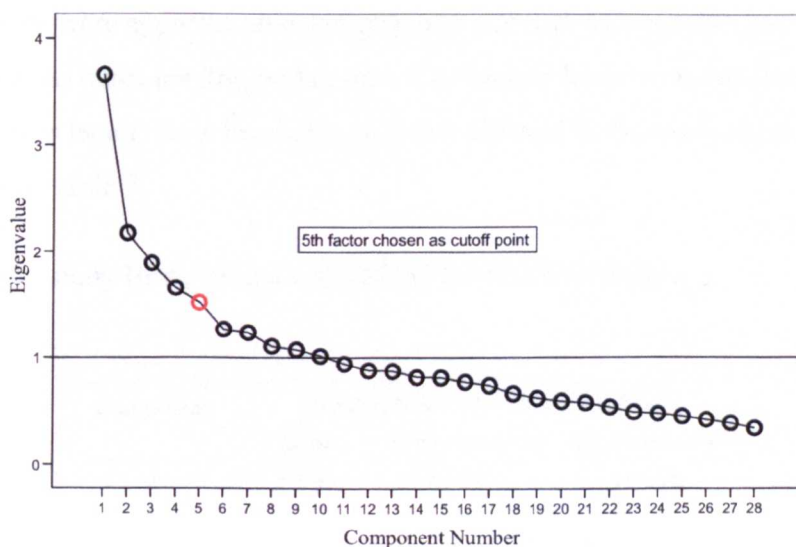


Figure 2: Scree plot of eigenvalues from PCA pilot factor analysis. The fifth factor is indicated in red, note also minor point of inflection at factor 7.

The fifth factor was chosen as the main cutoff (Catell 1966) in line with Schommer's (1990) underpinning model and the original validation results (Schraw *et al* 2002). Parallel analysis indicated extraction of five factors (table 4) indicated by the point where the raw data value dropped below that of the randomly generated data (Hayton 2004).

Table 4: Parallel analysis output for eigenvalues 1-6, 28 item EBI pilot.

Component	Raw data eigenvalue	Mean eigenvalue	Percentile eigenvalue
1	3.74	1.67	1.76
2	2.20	1.56	1.64
3	1.87	1.49	1.55
4	1.67	1.43	1.48
5	1.48	1.37	1.41
6	1.28	1.32	1.37

On inspection of the initial component matrix most of the loadings fell on the first factor as expected, factors 5-10 had very few loadings and there were several cross loadings. Varimax rotation provided the cleanest set of loadings and a simple factor structure (table 6). Five factors accounted for a lower proportion of variance (table 5) than the 60% total variance reported in the original validation (Schraw *et al* (2002). Cross loadings were apparent on items q05, q12 and q24 as opposed to Schraw *et al* (2002) where no items loading higher than 0.30 on one factor were reported to cross-load on another factor. How the factor structure differed in the loadings of items is summarised in table 7.

Table 5: Pilot study EFA, variance explained for first five factors

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.110	11.108	11.108
2	2.126	7.593	18.701
3	2.075	7.411	26.112
4	1.877	6.704	32.816
5	1.772	6.327	39.143

When a polychoric matrix was used, the results were very similar to those using Pearson correlations, the initial extraction again revealed 10 factors, which accounted for 66% of variance as opposed to 59.7%. The first eigenvalue was 4.79 compared to 3.73 in the Pearson correlation analysis and the scree plot indicated a clear break at the fifth factor and communalities were higher with a mean communality of 0.665. The component matrix following five factors was very similar and thus confirmed the decision to accept the previous five factor solution.

Table 6: Pilot study EFA component matrix following varimax rotation with five factor extraction specified. Factor labels are based on the highest loading items in each component.

Item	Component				
	1 QL	2 OA	3 IA	4 SK	5 CK
15 if you don't learn something quickly you won't ever learn it (QL)	.63				
27 working on a problem with no quick solution is a waste of time (QL)	.60				
18 if two people are arguing about something, at least one of them must be wrong (CK)	.55				
20 if you haven't understood a chapter the first time, going back over it won't help (QL)	.55				
3 students who learn quickly are the most successful (QL)	.54				
5 people's intellectual potential is fixed at birth (IA)	.45				.40
23 what is true today will be true tomorrow (CK)	.44				
25 when someone in authority tells me what to do, I usually do it (OA)		.70			
26 people shouldn't question authority (OA)		.64			
4 people should always obey the law (OA)		.61			
1 most things worth knowing are easy to understand (SK)		.48			
19 children should be allowed to question parent's authority (OA)		.45			
21 science is easy to understand because it contains so many facts (SK)	.21	.32			
8 really clever students don't have to work as hard to do well in school (IA)			.68		
16 some people just have a knack for learning and others don't (IA)			.61		
13 some people are born with special gifts and talents (IA)			.56		
14 how well you do in school depends on how clever you are (IA)	.42		.44		
24 clever people are born that way (IA)			.44		
17 things are simpler than most lecturers would have you believe (SK)				.64	
10 too many theories just complicate things (SK)				.63	
12 lecturers should focus on facts instead of theories (SK)	.41			.47	
28 sometimes there are no right answers to life's big problems (CK)	-.18		.28	-.31	.22
2 what is true is a matter of opinion (CK)					.59
22 the more you know about a topic, the more there is to know (CK)					.55
11 the best ideas are often the most simple (SK)					.44
6 absolute moral truth does not exist (OA)		.15	-.22		-.38
9 if a person tries too hard to understand a problem, they will end up confused (QL)	.13	.13		.25	.34
7 parents should teach children all there is to know about life (CK)	.25	.18		.13	.29

Table 7: Comparison of initial and pilot factor structures and loadings.

Schraw <i>et al</i> (2002) factor label	Item	Initial validation loading	Pilot study loading
Factor 1 - omniscient authority	q26	0.73	0.64
	q19	0.66	0.47
	q25	0.62	0.71
	q04	-	0.48
Factor 2 - certain knowledge	**	0.72	-
	q23	0.63	0.45 (QL)
	q07	0.50	-
	q02	-	0.59
	q22	-	0.58
Factor 3 - quick learning	q27	0.71	0.60
	q20	0.53	0.53
	q15	0.49	0.64
Factor 4 - simple knowledge	q12	0.78	0.48 *
	q10	0.57	0.63
	q01	0.44	0.48 (OA)
Factor 5 - innate ability	q14	0.76	0.46 (QL)
	q24	0.56	0.44 *
	q08	0.30	0.67
	q16	-	0.61
	q13	-	0.60

Key:

- signifies item did not load or loading was < 0.4

* signifies cross loading item in the pilot study

** signifies item not included in the final Schraw *et al* (2002) published version of the questionnaire.

Confirmatory Factor Analysis

Following identification of a solution using EFA, the five-factor model was further tested using confirmatory factor analysis procedure using a two-step approach to modelling (Schumacker & Lomax 1996). The five factors, quick learning and certain knowledge were indicated by five observed variables, and simple knowledge, innate ability and omniscient authority by six observed variables. The full hypothesised model is presented in figure 4; rectangles represent observed variables (EBI items) with their associated errors in circles, and ovals represent the latent variables, or factors. The five factors were allowed to covary with each other represented by double-headed arrows whilst single arrows connect measured variables to their errors.

The five-factor model (figures 4 and 5) did not fit well to the data on the basis of the Chi-square; $\chi^2 = (340, N = 286) = 731.54, p < .001$. However, using the chi square as a measure of absolute fit alone has been deemed unsatisfactory (Steiger 2007) and it can be inflated by large samples (greater than 200), or if the data are multivariate non-normal as in this sample. Additional goodness of fit indices were examined to test the structure of this model.

The χ^2/df ratio was 2.14; a ratio between one and three is regarded as an indication of a good fit of data to the model (Carmines & McIver, 1981). The comparative fit index (CFI), a measure based on non-centrality, was .60, so descriptively, the model did not fit well, as a value greater than .95 is the benchmark for this index (Hu & Bentler 1999). The root mean square error of approximation (RMSEA) was .064, with 90% confidence intervals = .057 to .070, which was more acceptable as values between 0.05 and 0.08 are seen as adequate and less than .05 are indicative of good fit (Hu & Bentler 1999). However, on the basis of the chi-square and fit indices, the model was rejected as the fit of the model to the data was unsatisfactory, possibly due to non-normality of the item response data, in turn a result of using a Likert scale for measurement (Brown 2006). A four factor model was tested resulting in $\chi^2 (71, N = 286) = 168.70, p < .001, RMSEA = 0.069, \chi^2/df = 2.37$ which again indicated a poor fit to the data.

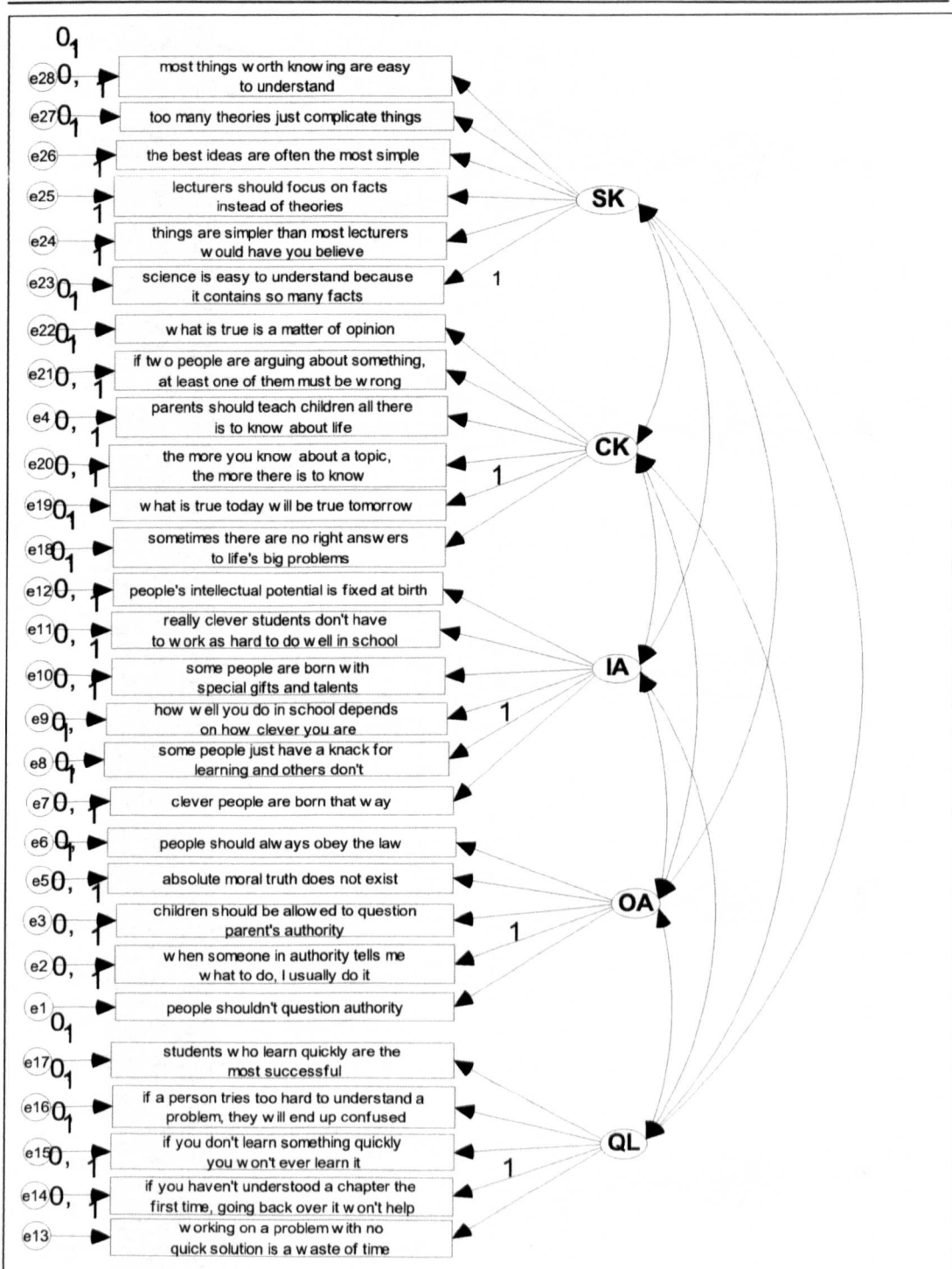


Figure 4: Twenty eight item EBI pilot confirmatory factor analysis model specification using AMOS 7.0.

Key: Latent variables; SK – simple knowledge, CK – certain knowledge, IA – innate ability, QL – quick learning, OA – omniscient authority; e – represents unobserved error.

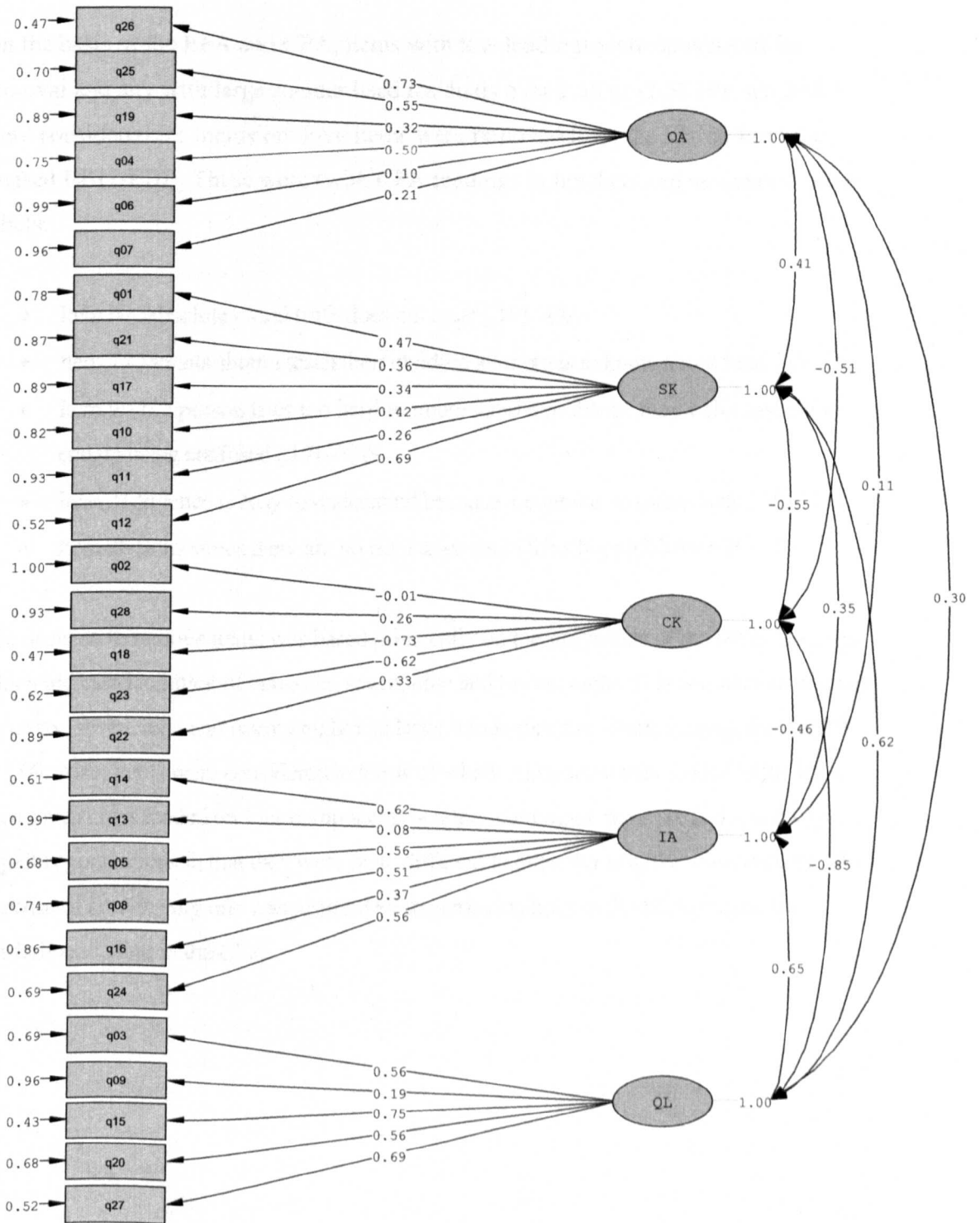


Figure 5: Twenty eight item EBI pilot confirmatory factor item level analysis model with standardised estimates. Key as previous figure 4.

Questionnaire Redesign

On the basis of the EFA and CFA, items with low loadings were considered for removal and any with large standardised residuals over 2.58 or -2.58 (Brown 2006) were considered for inclusion. Five items were removed from the EBI to form the revised EBI (rEBI). These were (with CFA loadings in brackets and associated factor labels:

- Item 6 - Absolute moral truth does not exist (.10) - OA.
- Item 7 - Parents should teach their children all there is to know about life (.21) - OA.
- Item 9 - If a person tries too hard to understand a problem, they will most likely end up being confused (.19) – QL.
- Item 21 Science is easy to understand because it contains so many facts (.36) - CK.
- Item 28 Sometimes there are no right answers to life's big problems (.26) - CK.

The decision to remove items was based principally on the magnitude of the factor loadings, which indicated removal of items six, seven, nine and twenty eight. This was also justified as items six, seven, nine and twenty eight had large standardized residuals ranging from -2.89 to 3.09. Also, items were considered in terms of which component they loaded in the EFA. Item seven cross loaded on four components and the wording of items six and seven was arguably contentious in that they were quite different to other items in the questionnaire. The removal of item twenty one was justified by the cross loadings in the EFA, despite the borderline loading in the CFA.

Appendix 7: An account of a typical survey administration session

Usually, the student cohorts on site one would be familiar with me and I would have been known to them through involvement in teaching and learning activities from very early on in the course until the end of branch. Typically, the survey would be distributed at the start of a timetabled session after the usual greetings and any administrative issues were dealt with, but before the main taught session began in earnest. If I was at the site where I had not had contact with students, I would approach them during a session co-ordinated by a colleague known to them and I would actively participate in teaching and learning activities with the students.

I would proceed by distributing printed copies of the survey to students and introducing them to the purpose of the survey:

'I would like to ask you if you could help me by participating in this educational survey. I'm approaching students in all cohorts in [both school sites] and the data collected will form part of my Ph.D. I'm interested in educational research and hopefully the usefulness of these questionnaires can be evaluated and we can use them in future to improve teaching and learning. Also, the process may give you some insight into being a research participant and spark your interest in research.

If you do not wish to participate, then that's okay, don't complete the survey and please return it when they are all collected at the end so they can be re-used. The process will take about fifteen minutes, after which I'll tell you a little more about the project and how you can participate in this project in future.'

By this point, the students would have a copy of the survey in front of them;

'Please read the instructions, and as they point out, when you fill in the scales please be careful to fill in all the questions. Don't think too hard about the questions, go with your initial impression and try to avoid going with 'three; unsure' if you can help it.'

When the students had finished completing the questionnaire, I would thank them for their participation and invite them to participate in the grounded theory stage of the project;

'I'll leave details of the next phase of the study on the corral (student information point) and you'll find an information sheet about the study and a consent form. This can be completed if you want to take part and the form will ask you about contact details, which can be either phone, email or via the corral, whatever suits you. You're details will be protected at all times, and if you sign up, but then later you decide not to take part, that's OK, just let me know. There are details about my supervisors, and if you have any questions you want to ask outside of this session, you know where to find me'.

Any questions would be addressed at the time the students asked and I would offer to tell them a little about the project so far in very general terms and why I was interested in pursuing the study. I would also offer to present the results to them at a later date if they were still on the programme.

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Table 1: Missing value analyses of the revised EBI.

Item	Total	Count	Item	Total	Count
EBIq01	197	0	EBIq13	196	1
EBIq02	197	0	EBIq14	197	0
EBIq03	196	1	EBIq15	197	0
FBIq04	196	1	FBIq16	196	1
EBIq05	197	0	EBIq17	197	0
EBIq06	195	2	EBIq18	197	0
EBIq07	197	0	EBIq19	196	1
EBIq08	197	0	EBIq20	196	1
EBIq09	196	1	EBIq21	197	0
EBIq10	197	0	EBIq22	197	0
EBIq11	197	0	EBIq23	197	0
EBIq12	196	1			

Table 2: Missing values analysis of ASSIST response data.

Item	Total responses	Missing Count	Item	Total responses	Missing Count
qA	187	10	q29	178	19
qB	187	10	q30	178	19
qC	187	10	q31	177	20
qD	186	11	q32	177	20
qE	187	10	q33	177	20
qF	187	10	q34	178	19
q01	196	1	q35	178	19
q02	196	1	q36	177	20
q03	195	2	q37	177	20
q04	196	1	q38	178	19
q05	195	2	q39	177	20
q06	195	2	q40	178	19
q07	196	1	q41	178	19
q08	196	1	q42	178	19
q09	196	1	q43	189	8
q10	196	1	q44	197	0
q11	196	1	q45	196	1
q12	196	1	q46	196	1
q13	195	2	q47	197	0
q14	179	18	q48	197	0
q15	179	18	q49	197	0
q16	179	18	q50	197	0
q17	179	18	q51	197	0
q18	178	19	q52	197	0
q19	178	19	q53	197	0
q20	177	20	q54	196	1
q21	178	19	q55	197	0
q22	178	19	q56	197	0
q23	178	19	q57	197	0
q24	178	19	q58	197	0
q25	177	20	q59	197	0
q26	178	19	q60	197	0
q27	178	19	qEnd	173	24
q28	178	19			
Total	6337	361		6194	307
Total complete and missing responses				12531	668

Table 3: Communalities for individual EBI items

Item	Initial	Extraction	Item	Initial	Extraction
q01	1.000	.575	q13	1.000	.550
q02	1.000	.795	q14	1.000	.612
q03	1.000	.584	q15	1.000	.539
q04	1.000	.633	q16	1.000	.693
q05	1.000	.490	q17	1.000	.654
q06	1.000	.502	q18	1.000	.696
q07	1.000	.646	q19	1.000	.575
q08	1.000	.417	q20	1.000	.632
q09	1.000	.591	q21	1.000	.703
q10	1.000	.470	q22	1.000	.648
q11	1.000	.484	q23	1.000	.423
q12	1.000	.603			
		6.79			6.725

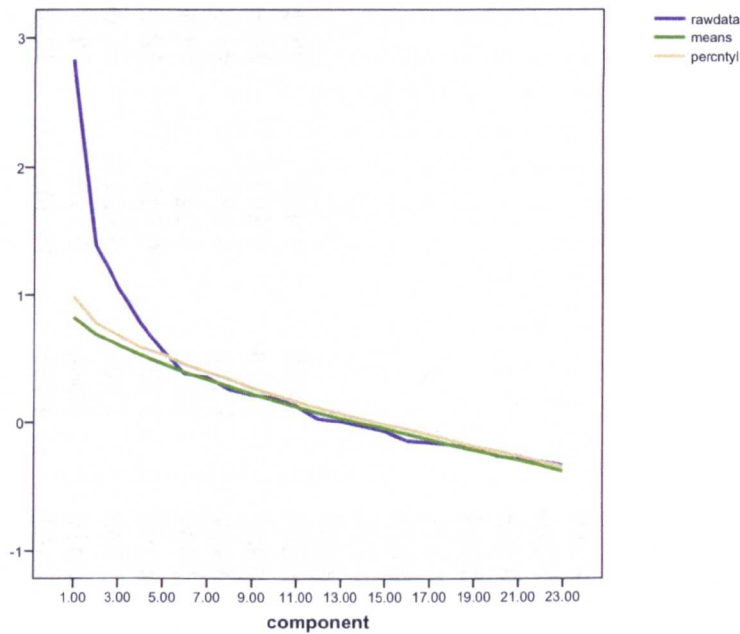


Figure 1: Parallel analysis of the revised EBI. Y-axis represents the eigenvalue.

Table 4: Results of parallel analysis of the revised EBI data.

Root	Raw data eigenvalue	Mean eigenvalue	Percentile eigenvalue
1	2.83	.83	.99
2	1.39	.70	.78
3	1.06	.61	.69
4	.782	.53	.59
5	.568	.46	.54
6	.381	.39	.46

Table 5: Revised EBI total variance explained

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings	
	Total	% of Variance	Total	% of Variance	Total	% of Variance
1	3.521	15.307	3.521	15.307	2.575	11.194
2	2.095	9.110	2.095	9.110	2.423	10.533
3	1.766	7.677	1.766	7.677	1.846	8.026
4	1.529	6.649	1.529	6.649	1.661	7.221
5	1.323	5.752	1.323	5.752	1.386	6.028
6	1.146	4.981	1.146	4.981	1.216	5.288
7	1.119	4.865	1.119	4.865	1.212	5.271
8	1.018	4.428	1.018	4.428	1.198	5.208
9	.994	4.322				
10	.937	4.075				
11	.874	3.800				
12	.770	3.346				
13	.755	3.283				
14	.705	3.064				
15	.667	2.901				
16	.581	2.526				
17	.531	2.309				
18	.524	2.277				
19	.513	2.230				
20	.486	2.112				
21	.438	1.905				
22	.387	1.682				
23	.322	1.400				

Initial Eigenvalues		Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings	
Total	Cumulative %	Total	% of Variance	Total	% of Variance
	15.307	3.521	15.307	2.575	11.194
	24.416	2.095	9.110	2.423	21.726
	32.093	1.766	7.677	1.846	29.753
	38.742	1.529	6.649	1.661	36.973
	44.494	1.323	5.752	1.386	43.001
	49.475	1.146	4.981	1.216	48.289
	54.340	1.119	4.865	1.212	53.560
	58.768	1.018	4.428	1.198	58.768
	63.090				
	67.165				
	70.965				
	74.311				
	77.594				
	80.659				
	83.560				
	86.086				
	88.395				
	90.672				
	92.902				
	95.013				
	96.918				
	98.600				
	100.000				

Table 6: Component matrix after EFA of the polychoric matrix and varimax rotation, five factors extracted.

	Component				
	1	2	3	4	5
q17	.796				
q15	.759				
q23	.693				
q12	.684	.310			
q19	.556				
q20		.763			
q5		.648			
q10		.636			
q6		.628			
q13		.565			
q11		.517			
q18	-.311	.315			
q22			.793		
q4			.768		
q21			.723		
q3		.311	.394		
q7				.690	
q1				.614	.432
q9				.578	
q14				.542	
q8		.378		.397	.319
q2					
q16					.759

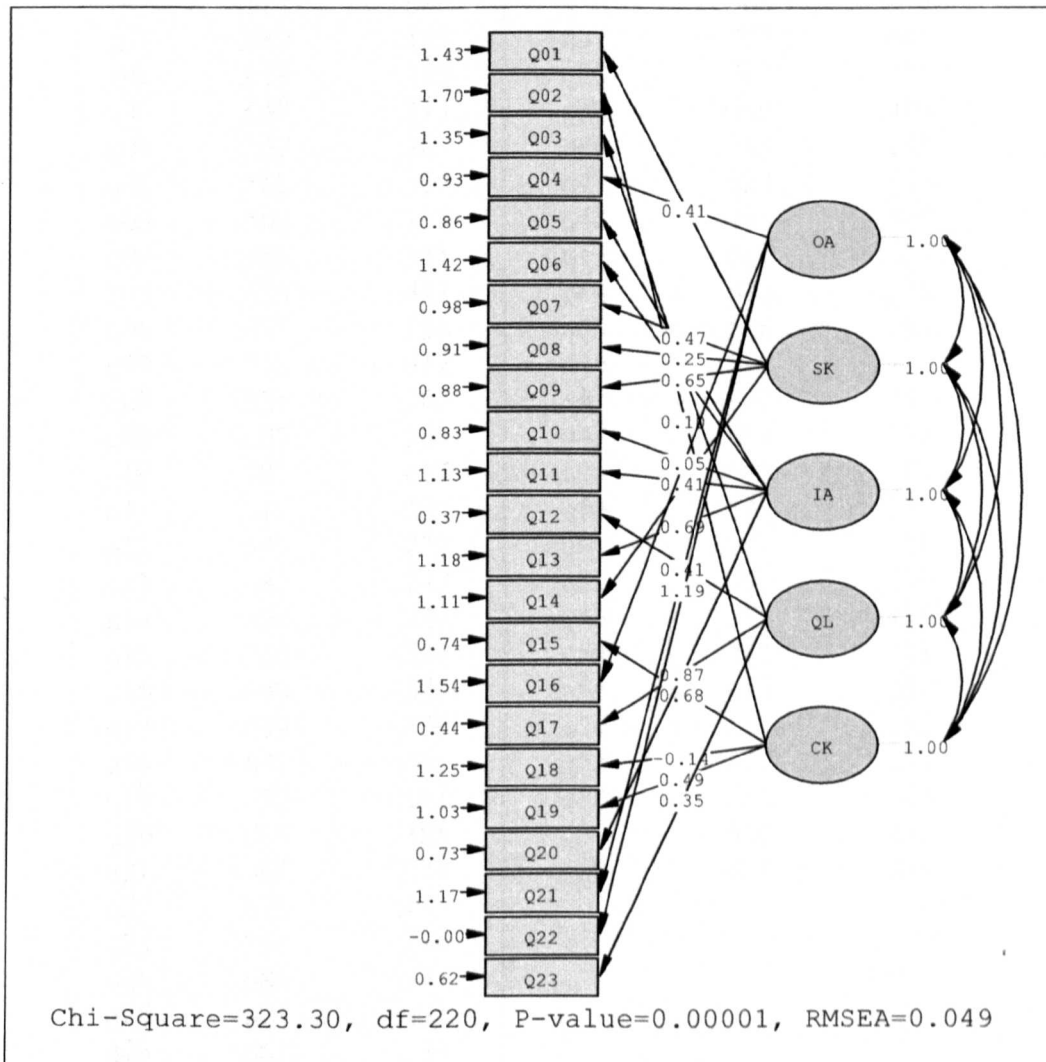


Figure 2: Specification model and standard parameter estimates for the revised EBI data five factor CFA.

Table 7: ASSIST Communalities.

Item	Initial	Extraction	Item	Initial	Extraction
qA	.469	.036	q34	.693	.427
qB	.616	.189	q35	.666	.410
qC	.584	.080	q36	.668	.476
qD	.689	.175	q37	.737	.612
qE	.652	.155	q38	.503	.133
qF	.647	.113	q39	.690	.408
q01	.537	.247	q40	.563	.200
q02	.562	.134	q41	.523	.123
q03	.509	.177	q42	.708	.369
q04	.588	.331	q43	.667	.377
q05	.635	.443	q44	.616	.275
q06	.485	.156	q45	.625	.183
q07	.713	.412	q46	.571	.134
q08	.581	.285	q47	.662	.352
q09	.607	.338	q48	.669	.358
q10	.781	.617	q49	.649	.383
q11	.519	.294	q50	.528	.375
q12	.542	.226	q51	.517	.316
q13	.483	.247	q52	.593	.220
q14	.594	.206	q53	.571	.154
q15	.705	.501	q54	.713	.311
q16	.699	.370	q55	.613	.285
q17	.639	.300	q56	.567	.152
q18	.671	.475	q57	.615	.170
q19	.632	.185	q58	.665	.217
q20	.686	.488	q59	.610	.293
q21	.667	.487	q60	.609	.234
q22	.675	.489			
q23	.354	.070			
q24	.686	.341			
q25	.678	.431			
q26	.687	.379			
q27	.504	.198			
q28	.608	.164			
q29	.604	.255			
q30	.549	.341			
q31	.719	.455			
q32	.436	.048			
q33	.647	.264			

Table 8: Pattern matrix of individual items following ML extraction of three factors and oblique rotation (loadings less than 0.3 omitted).

Item	Factor 1	Factor 2	Factor 3	Item	Factor 1	Factor 2	Factor 3
q21	.669			q22		.656	
q36	.663			q48		.637	
q26	.648			q35		.633	
q30	.591			q51		.572	
q43	.588			q08		.440	
q49	.584			q57		.419	
q54	.583			q28		.400	
q15	.575			q56		.395	
q10	.569	.410		q53		.391	
q39	.555			q60		.391	
q42	-.552			q06		.369	
q09	.548			q45		.339	
q07	.525			q41		.338	
q16	-.515			q38		.337	
q17	.514			q02			
q33	.513			q32			
q55	.513			q05			.728
q59	.509			q31			.683
q04	.509			q18			.669
q34	.499			q50			.580
q11	.476			q37	.364		.553
q13	.473			q44			.504
q52	.464			q14			.485
q58	.437			q40			.455
q20	.433		.314	q24	.329		.356
q25	-.415	.326	-.302	q03			-.350
qD	.370			q01			.331
qB	.370			q47	.318		.328
q29	-.369			q12			-.314
q27	.356						
qE	.322						
q19							
q46							
q23							
qF							
qC							
qA							

Table 9: Factor matrix of individual ASSIST items following ML extraction of three factors and varimax rotation (loadings less than 0.3 omitted).

Item	Factor			Item	Factor		
	1	2	3		1	2	3
q21	.685			q31		.719	
q26	.684			q05		.702	
q10	.653		.343	q18		.687	
q39	.645			q37	.493	.584	
q36	.636			q50		.582	
q16	-.629			q44		.566	
q42	-.624			q14		.469	
q49	.589			q40		.456	
q15	.588	.321		q01	.318	.403	
q43	.577			q12		-.337	
q30	.569			q22			.727
q09	.569			q48			.707
q34	.564			q35			.659
q07	.554	.302		q51			.571
q20	.526	.387		q08			.511
q13	.507			q45			.465
q11	.506			q06			.369
q29	-.492			q28			.368
q17	.489			q03			.328
q33	.482			q38			.323
q04	.480			q41			.309
q52	.467			q02			
q24	.435	.384		q32			
q25	-.421	-.326	.320				
q47	.409	.349					
q27	.316						
q19	-.310						
q23							
q46							

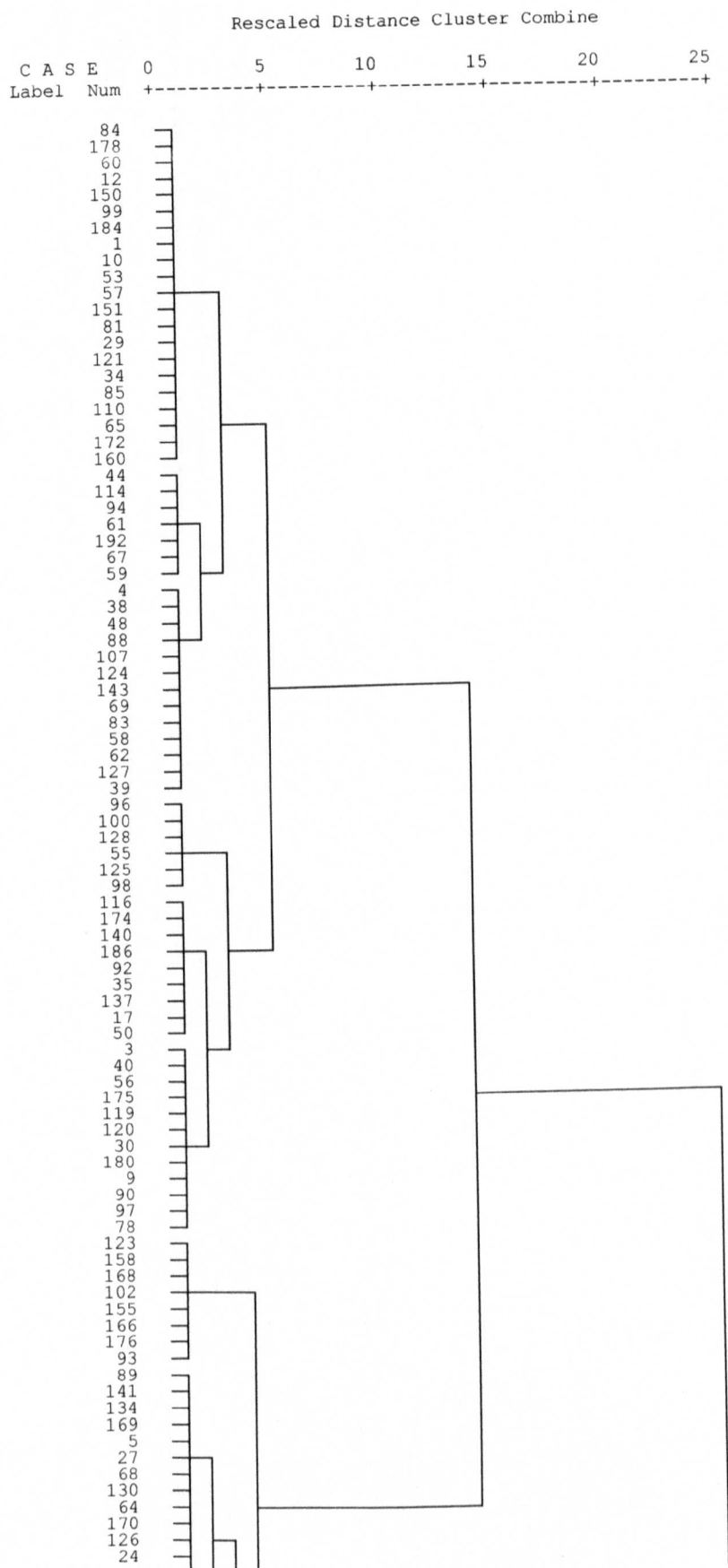
Table 10: Descriptive statistics for individual item responses to the revised EBI.

Item	Mode	<i>M</i>	<i>SD</i>	Item	Mode	<i>M</i>	<i>SD</i>
q01	4	3.07	1.32	q13	4	3.36	1.28
q02	4	3.11	1.31	q14	4	3.06	1.14
q03	2	2.27	1.23	q15	1	1.89	1.12
q04	4	4.07	1.05	q16	4	2.99	1.24
q05	2	2.13	1.10	q17	1	1.51	.85
q06	4	2.92	1.36	q18	4	3.84	1.15
q07	4	3.59	1.08	q19	2	2.10	1.15
q08	4	3.97	.984	q20	2	2.25	1.22
q09	2	2.97	1.16	q21	4	3.55	1.158
q10	4	4.07	.982	q22	2	2.34	1.21
q11	2	2.46	1.25	q23	1	1.72	.86
q12	1	1.55	.80				

Table 11: Likert responses for individual rEBI items.

Item	1.00 disagree		2.00 disagree somewhat		3.00 unsure		4.00 agree somewhat		5.00 agree	
	count	%	count	%	count	%	count	%	count	%
Most things worth knowing are easy to understand	31	15.7%	51	25.9%	13	6.6%	80	40.6%	22	11.2%
What is true is a matter of opinion	29	14.7%	46	23.4%	16	8.1%	82	41.6%	24	12.2%
Students who learn quickly are the most successful	59	30.1%	81	41.3%	11	5.6%	34	17.3%	11	5.6%
People should always obey the law	4	2.0%	22	11.2%	12	6.1%	79	40.3%	79	40.3%
People's intellectual potential is fixed at birth	60	30.5%	94	47.7%	11	5.6%	25	12.7%	7	3.6%
Really clever students don't have to work as hard to do well in school	35	17.9%	58	29.7%	13	6.7%	66	33.8%	23	11.8%
Too many theories just complicate things	8	4.1%	39	19.8%	10	5.1%	109	55.3%	31	15.7%
The best ideas are often the most simple	4	2.0%	20	10.2%	16	8.1%	97	49.2%	60	30.5%
Lecturers should focus on facts instead of theories	12	6.1%	80	40.8%	29	14.8%	57	29.1%	18	9.2%
Some people are born with special gifts and talents	5	2.5%	18	9.1%	6	3.0%	100	50.8%	68	34.5%
How well you do in school depends on how clever you are	45	22.8%	87	44.2%	11	5.6%	41	20.8%	13	6.6%
If you don't learn something quickly you won't ever learn it	114	58.2%	67	34.2%	4	2.0%	11	5.6%	0	0
Some people just have a knack for learning and others don't	23	11.7%	41	20.9%	9	4.6%	93	47.4%	30	15.3%
Things are simpler than most lecturers would have you believe	12	6.1%	71	36.0%	23	11.7%	77	39.1%	14	7.1%
If two people are arguing about something, at least one of them must be wrong	93	47.2%	71	36.0%	3	1.5%	25	12.7%	5	2.5%
Children should be allowed to question parent's authority	20	10.2%	68	34.7%	17	8.7%	70	35.7%	21	10.7%
If you haven't understood a chapter the first time, going back over it won't help	127	64.5%	54	27.4%	5	2.5%	9	4.6%	2	1.0%
The more you know about a topic, the more there is to know	10	5.1%	21	10.7%	19	9.6%	86	43.7%	61	31.0%
What is true today will be true tomorrow	70	35.7%	81	41.3%	8	4.1%	32	16.3%	5	2.6%
Clever people are born that way	64	32.7%	77	39.3%	9	4.6%	37	18.9%	9	4.6%
When someone in authority tells me what to do, I usually do it	10	5.1%	44	22.3%	8	4.1%	102	51.8%	33	16.8%
People shouldn't question authority	53	26.9%	86	43.7%	9	4.6%	41	20.8%	8	4.1%
Working on a problem with no quick solution is a waste of time	90	45.7%	85	43.1%	11	5.6%	8	4.1%	3	1.5%

Figure 3: Hierarchical cluster analysis dendrogram using Ward Method



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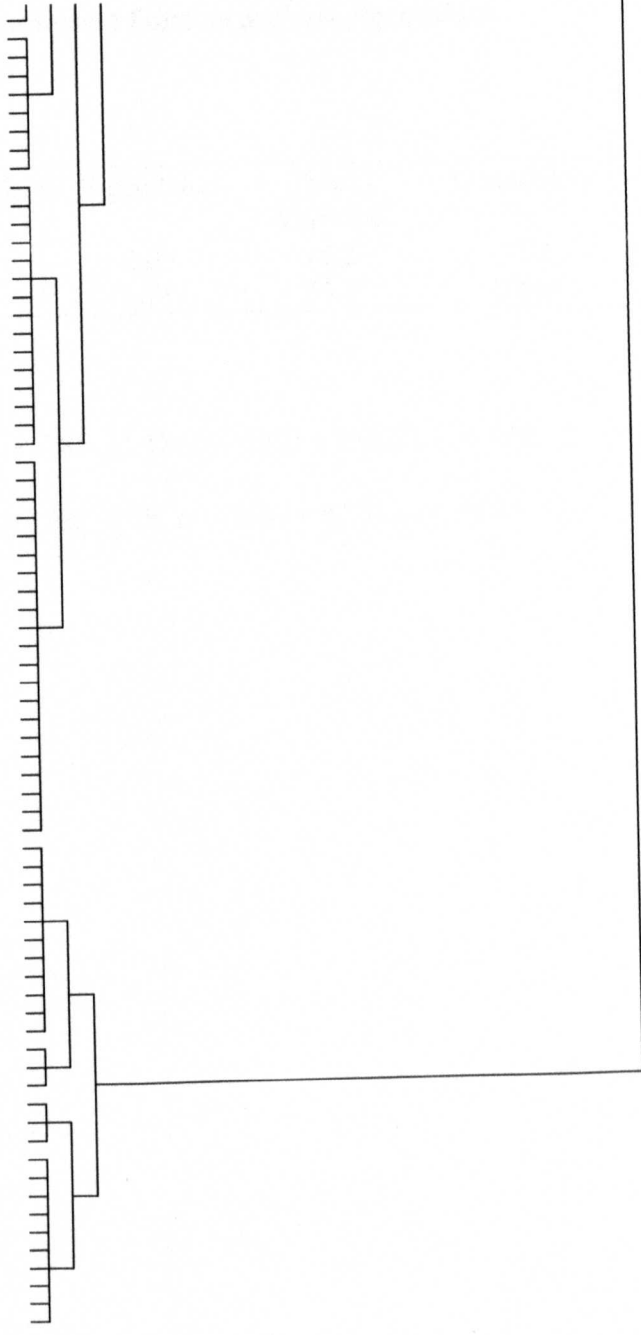


Table 12: Discriminant function analysis eigenvalues.

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	2.09	75.2	75.2	.82
2	.69	24.8	100.0	.64

Function 1, $\Lambda = .185$, $\chi^2(18, N = 160) = 258.36$, $p < .001$

Function 2, $\Lambda = .582$, $\chi^2(8, N = 160) = 82.81$, $p < .001$

Table 13: Multinomial logistic regression analysis of cluster membership using EBI subscale and ASSIST total scores (reference cluster 1).

Cluster	B	SE B	Wald's χ^2	df	p	eB odds ratio	95% Confidence Interval for eB	
							Upper	Lower
2	Intercept	-19.58	18.58	1	.000			
	OA median	2.07	.86	1	.016	7.89	1.46	42.67
	QL median	1.24	.45	1	.006	3.44	1.43	8.30
	IA median	2.12	.80	1	.006	8.99	1.89	42.91
	SK median	.708	.42	1	.092	2.03	.89	4.62
	ASSIST score	.042	.02	4.09	1	.043	1.04	1.00
3	Intercept	13.85	2.45	1	.118			
	OA median	.58	1.29	1	.650	1.79	.14	22.20
	QL median	3.69	.89	17.21	1	39.87	6.99	227.46
	IA median	3.01	1.31	5.32	1	20.32	1.57	262.53
	SK median	.88	.81	1.18	1	2.40	.49	11.65
	ASSIST score	-.21	.058	12.79	1	.000	.81	.73
Overall model evaluation								
Likelihood ratio test			χ^2	df	p			
Pearson			181.99	10	.000			
Deviance			206.91	308	1.00			
			130.66	308	1.00			

Pseudo R² - Cox & Snell .68, Nagelkerke .79, McFadden .58.

Table 14: Likelihood ratio tests indicating contribution of each variable to the model.

Effect	Model fitting criteria		Likelihood ratio tests	
	-2 Log likelihood of reduced model	χ^2	df	P
Intercept	184.54	53.89	2	.000
OA median	137.82	7.16	2	.028
QL median	162.62	31.97	2	.000
IA median	140.73	10.08	2	.006
SK median	133.89	3.23	2	.199
ASSIST score	220.77	90.11	2	.000

Calculation 1: Proportional by chance accuracy calculation.

Figures in the calculation are obtained from the case processing summary and represent the number of cases defined by the dependent variable, in this case, the cluster membership derived from the discriminant function analysis.

$$(0.269^2 + 0.563^2 + 0.169^2) = 0.417891 \text{ or } 41.8\% \times 1.25 = 52.25\%$$

Table 15: Kruskal-Wallis test results comparing the subscale scores of the three cluster groups derived from cluster analysis.

	IA median	QL median	SK median	OA median	ASSIST score
<i>H</i>	28.519	34.106	40.746	20.294	56.448
<i>Df</i>	2	2	2	2	2
<i>P</i>	< .001	< .001	< .001	< .001	< .001

Table 16: Kruskal-Wallis test results comparing the subscale scores of the three cluster groups derived from multinomial logistic regression.

	IA median	QL median	SK median	OA median	ASSIST score
<i>H</i>	27.647	36.713	38.885	21.491	59.219
<i>df</i>	2	2	2	2	2
<i>p</i>	< .001	< .001	< .001	< .001	< .001

Table 17: Results of Mann-Whitney test comparing survey scores between clusters 1 & 3.

	Deep median	Strategic median	Surface median	OA median	SK median	QL median	IA median	EBI score	ASSIST score
Mann-Whitney <i>U</i>	79.0	49.50	202.0	453.0	226.5	405.0	195.0	74.0	117.0
Wilcoxon <i>W</i>	457.0	427.50	1148.000	1399.0	1172.5	1351.0	1141.0	1020.0	495.0
Z	-6.05	-6.41	-4.57	-1.558	-4.306	-2.180	-4.665	-6.119	-5.595
P	<.001	<.001	<.001	.119	<.001	.029	<.001	<.001	<.001

Table 18: Results of Mann-Whitney test comparing survey scores between clusters 1 & 2.

	Deep median	Strategic median	Surface median	OA median	SK median	QL median	IA median	EBI score	ASSIST score
Mann-Whitney <i>U</i>	1706.0	1878.0	578.0	1026.0	687.0	646.5	1114.0	257.5	1271.0
Wilcoxon <i>W</i>	5801.0	5973.0	1524.0	1972.000	1633.0	1592.5	2060.0	1203.5	2217.0
Z	-1.103	-2.74	-6.535	-4.400	-6.039	-6.250	-3.964	-8.077	-3.195
P	.270	.784	<.001	<.001	<.001	<.001	<.001	<.001	.001

Table 19: Results of Mann-Whitney test comparing survey scores between clusters 2 & 3.

	Deep median	Strategic median	Surface median	OA median	SK median	QL median	IA median	EBI score	ASSIST score
Mann-Whitney <i>U</i>	208.0	116.50	1205.0	841.5	1109.5	936.5	809.	1196.0	108.5
Wilcoxon <i>W</i>	586.0	494.5	5300.0	1219.5	1487.5	1314.5	4904.0	5291.0	486.0
Z	-6.52	-7.110	-0.065	-2.433	-6.88	-1.815	-2.637	-1.23	-7.160
P	<.001	<.001	.948	.015	.491	.070	.008	.902	<.001

Table 20: Follow-up ANOVAs after cluster analysis and discriminant function analysis.

Variable		Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
Deep approach mean	Between Groups	24.929	2	12.465	48.676	< .001
	Within Groups	40.204	157	.256		
	Total	65.134	159			
Strategic approach mean	Between Groups	27.418	2	13.709	63.796	< .001
	Within Groups	33.737	157	.215		
	Total	61.155	159			
Surface approach mean	Between Groups	13.026	2	6.513	30.443	< .001
	Within Groups	33.589	157	.214		
	Total	46.615	159			
IA mean	Between Groups	17.179	2	8.589	18.331	< .001
	Within Groups	73.565	157	.469		
	Total	90.744	159			
SK mean	Between Groups	19.519	2	9.759	28.199	< .001
	Within Groups	54.336	157	.346		
	Total	73.855	159			
QL mean	Between Groups	12.267	2	6.134	19.093	< .001
	Within Groups	50.437	157	.321		
	Total	62.704	159			
OA mean	Between Groups	7.069	2	3.534	8.567	< .001
	Within Groups	64.771	157	.413		
	Total	71.839	159			

Table 21: Post-hoc comparisons following ANOVAs after cluster analysis and discriminant function analysis using Hochberg GT2 procedure for unequal sample sizes.

			Mean Difference (I-J)	Std. Error	Sig.
Deep approach mean	1	2	.11303	.09381	.542
		3	1.12252	.12426	.000
	2	1	-.11303	.09381	.542
		3	1.00949	.11104	.000
	3	1	-1.12252	.12426	.000
		2	-1.00949	.11104	.000
Strategic approach mean	1	2	.01854	.08594	.995
		3	1.11761	.11382	.000
	2	1	-.01854	.08594	.995
		3	1.09907	.10172	.000
	3	1	-1.11761	.11382	.000
		2	-1.09907	.10172	.000
Surface approach mean	1	2	-.64331	.08575	.000
		3	-.64470	.11357	.000
	2	1	.64331	.08575	.000
		3	-.00139	.10149	1.000
	3	1	.64470	.11357	.000
		2	.00139	.10149	1.000
IA mean	1	2	-.51641	.12690	.000
		3	-.99727	.16808	.000
	2	1	.51641	.12690	.000
		3	-.48086	.15020	.005
	3	1	.99727	.16808	.000
		2	.48086	.15020	.005
OA mean	1	2	-.71835	.15164	.000
		3	-.31094	.20085	.326
	2	1	.71835	.15164	.000
		3	.40741	.17949	.072
	3	1	.31094	.20085	.326
		2	-.40741	.17949	.072
SK mean	1	2	-.80165	.10906	.000
		3	-.73351	.14445	.000
	2	1	.80165	.10906	.000
		3	.06815	.12909	.935
	3	1	.73351	.14445	.000
		2	-.06815	.12909	.935
QL mean	1	2	-.64858	.10507	.000
		3	-.40413	.13917	.013
	2	1	.64858	.10507	.000
		3	.24444	.12437	.145
	3	1	.40413	.13917	.013
		2	-.24444	.12437	.145

