Student nurses' experiences of and perspectives on their learning of bioscience on a contemporary nursing degree programme.

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Abstract

This thesis explores the experiences of adult-field student nurses learning bioscience while completing a BSc (Hons) Nursing course. It uses both quantitative and qualitative data to establish the perspectives of a contemporary group of students on bioscience as a nursing subject and their experiences of learning the biosciences in both classroom and practice. This thesis rejects traditional academic focussed methodology in favour of a humanistic, student-centred, and libertarian approach, which engaged student nurses in unsupervised authentic and naturalistic conversations about their learning experiences. Questionnaire data from 164 final year students found that historic notions of deficiency in nurse education, often referred to as “the bioscience problem”, remain a cause for concern for current students, particularly in terms of inducing anxiety, subject complexity, and a lack of classroom time. Qualitative data from 4 unsupervised focus groups of final year nursing students uncovered six concepts that describe the student experience of learning bioscience to prepare for nursing practice. The six concepts, *indispensability, deficiency, burden, angst, reality*, and *identity,* collectively inform nursing academics that the learning of bioscience is disrupted by two tensions or paradoxes. Firstly, there is a value and discomfort paradox in that while bioscience is viewed by students as indispensable, it is simultaneously considered academically burdensome. Secondly, while considered vital for clinical practice, students feel the learning of bioscience alongside qualified nurses is problematic and inadequate. This thesis will conclude that if the quality of bioscience education is to improve, attention needs to be paid to both paradoxes. It will recommend that further research into active and blended learning and authentic assessments could reduce the tension between perceived value and academic burden and that a more evident and

symbiotic relationship between academics and qualified nurses could enhance the student's practice learning experiences.

Chapter 1

Introduction

The difficulties that student nurses have in learning human biosciences have given cause for concern for over 20 years, but the problem remains" (*McVicar et al., 2015:500).*

This introductory chapter aims to set this reflexive thesis into context. It seeks to explain its evolution from a reflective exercise through to a completed research project that concludes with recommendations for both nurses and teachers. Each phase of the study is introduced to encapsulate the inspirations and motivations that informed this work. As the chapter progresses, the results and findings of each phase are summarised. These summaries are intended to give the reader a broad overview of the thesis and its intended aims. The chapter concludes with a breakdown of each of the remaining 7 chapters. This latter section is included to provide a guide to the reader and better enable them to negotiate the whole thesis. The chapter commences, however, with a brief overview of the research questions, thesis structure and findings.

1.1 The research questions.

Throughout my teaching career I have been engaged by the widely discussed notion that the teaching and learning of bioscience in nurse education is flawed. This idea is often encapsulated in the so-called "bioscience problem," an umbrella term for a collection of disparate pedagogical issues hypothesised over many years in literature from different continents. The issues discussed under the banner of "bioscience problem" corresponded with my experiences as student nurse, practising

nurse, and nurse tutor, and this combination of academic discourse and professional experience provided the platform on which this thesis is based. While a ubiquitous concern in nursing literature, much of the evidence that the teaching and learning of bioscience in nurse education is flawed is historic. Nevertheless, many of the concerns discussed in the literature correspond with my professional experience which led me to question to what extent is bioscience education problematic for modern students. Furthermore, there was a lack of a phenomenological insight into the lived experiences of contemporary students. Gaining insight into the student experience could enlighten the reasons why they found the biosciences challenging, which in turn could provide guidance to nursing academics on how to enhance student learning.

The aim of this thesis, therefore, was to address the following questions:

1) To what extent do the biosciences remain a cause for concern among contemporary adult-field students completing a BSc (Hons) Nursing programme?
2) What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?

In seeking to answer both questions a mixed methods approach was taken. In the first phase a questionnaire was completed by 164 final year adult-field nursing students. The resulting quantitative data demonstrated that bioscience remains a cause for concern of student nurses, especially in terms of anxiety, complexity, and classroom time.

Further reflection on my professional journey led me to question the validity of traditional data collection methods to access the student voice. I felt that the presence of a researcher when using established methods such as interviews and

focus groups restricted the student voice. I became interested in the unencumbered student voice as a method of accessing hitherto unheard perspectives. In seeking to answer research question two, four unsupervised focus groups were organised in which students were free to discuss whatever they deemed important, free from interruption or mediation. In doing so I aimed to access unguarded and natural conversations, free from academic interference. The qualitative data from the four unsupervised focus groups found that students described their perspectives and experiences as six concepts, which are *indispensability, deficiency, burden, angst, reality,* and *identity*. Analysis of these six concepts highlighted that the learning of bioscience was impeded by two tensions or paradoxes. While the students place a high value on the biosciences in terms of informing their nursing practice, they simultaneously found mastering them challenging and cumbersome, and learning while working with qualified nurses, problematic and inefficient. This thesis describes these phenomena as the value and discomfort paradox and the value and reality of nursing practice paradox.

1.2 A reflexive thesis.

This is a reflexive thesis in that it recognises the acceptance of responsibility of the influence of self and personal perspectives on data analysis and research findings (Finlay, 2003). The inclusion of reflection in this initial chapter is an attempt to clarify my biography and its potential influence and bias on the research findings. As Davis (2020) contends, it is vital that researchers are transparent about their relationship with the subject and the participants. This is in part because themes identified in data do not always emerge naturally. Rather, they can be shaped by the individual researcher's decisions and choices, which are inevitably influenced by

their perspectives and experiences. Furthermore, being honest about relationships, experiences, and perspectives, and their potential impact on data analysis, argues Palaganas et al. (2017), fosters trust in the reader and ensures findings are rigorous and transparent. Reflexivity, therefore, is an attempt to explain and justify the motivations behind the execution of this research and to safeguard honesty and rigour in the analysis of the data and to ensure a degree of authenticity in the research and its findings (Denzin & Lincoln, 2018). Professionally, such a starting point also felt natural as reflexivity is embedded into the philosophy of nursing practice and self-development (Royal College of Nursing (RCN), 2021; Nursing and Midwifery Council, 2018a; English et al., 2022).

The initial inspiration for this thesis was a reflection on my introduction to nurse education in 2002 and my first teaching experiences. Later, at the initial outset of this research, the work of McVicar et al. (2014; 2015) exploring the historic challenges faced by tutors and students when teaching and learning the biosciences provided key insights into a pedagogical phenomenon that I found fascinating. This led to further reflection on my professional journey, from student nurse to senior lecturer and my relationship with the biosciences, as a learner, a staff nurse, using bioscience when caring for people, and as a tutor.

1.3 Learning bioscience – Reflections of a former student nurse.

My start in nursing coincided with a radical change in nurse education and the biggest ever change in the preparation of learners for nursing practice (Le Var, 1997). From 1989 onwards, nursing colleges gradually adopted Project 2000, a move away from traditional training to an education pathway leading to a recognised qualification. Project 2000 was subject to intense scrutiny from staff and students,

particularly in relation to its structure which some teachers felt was confusing and incomplete. Students also felt the new courses were illogical containing subjects that were difficult to contextualise (Jowett, 1995). Trnobranski (1996) attributed this to a change of emphasis or priorities within nurse education, with classroom time dedicated to bioscience being reduced to accommodate more social science instruction. I certainly remember feelings of dissatisfaction with my own course, which I felt focussed more on social science than bioscience. As student nurse, I believed the biosciences were the very essence of nursing theory, and that all other topics, such as social science, while important, were peripheral and less essential. My ability to care for another human being was predicated on my understanding of the human body and the impact of disease processes on wellbeing. For me and my peers working in clinical settings with insufficient knowledge of anatomy and physiology was unthinkable. In retrospect our respect for the biological sciences also helps explain why my peers and I were able to accept, without question, the "sending home" of a colleague who failed to pass their 2nd-year physiology exam, thus ending their dream of becoming a staff nurse. While there was regret that someone who possessed the values, temperament, and aptitude for nursing would not be able to fulfil their desire to qualify as a nurse, there was no question among the students that this was an incorrect decision. If you cannot understand the bioscience, the theory went, then how are you going to be able to look after sick people?

1.4 Using bioscience – Reflections of a former staff nurse.

Despite my fascination for human biology, it was not until I was an established staff nurse that I began to fully appreciate it. In my first staff nurse post I remember

feelings of inadequacy in terms of bioscience. I would feel embarrassed at my lack of physiological knowledge in contrast to my more experienced colleagues and would secretly hope a doctor or senior nurse would not probe to deeply into my decisions or interpretations of clinical data. Through subsequent reading it has become clear that my anxieties were not unique. Research executed around the time of my initial clinical experiences demonstrates a lack of confidence in bioscience knowledge as well as feelings of subservience to other professions, medicine in particular (Wilkes & Batts, 1998; Campbell & Leathard, 2000).

It was while studying an English National Board (ENB) cardiorespiratory nursing course that I had what I would describe as my first pedagogical epiphany. My understanding of the physiology that underpins fundamental determinants of human life, oxygenation, and blood pressure, for example, was for the first time fully illuminated. It was an experience akin to fog lifting and being able to see a clear road ahead or switching from black and white to colour. Motivated by my new knowledge I set about a change in my practice, which would eventually pave the way for a move into higher education and in turn the completion of this thesis. I began to focus on education, not only for student nurses but my qualified colleagues also.

1.5 Teaching bioscience – Reflections of a nurse teacher.

I recall my earliest ventures into teaching clearly. I was tasked with teaching several body systems to 1st year students and spent the preceding summer painstakingly assembling presentations on the cardiovascular system, respiratory system, renal system, and the integumentary system. My students were enthusiastic, engaged, and eager to learn but while they remained vociferous about the need for anatomy and physiology, they simultaneously bemoaned the lack of

time spent discussing the human body in the classroom. In class, students would look physically uncomfortable when attempting to express their understanding of physiological concepts and presenting work would make them visibly anxious. They would also vocalise discontent regarding the challenge of learning what they perceived to be overly complex and anxiety-inducing topics. Arguably, the anxiety and ordeal of learning intricate physiological theories impacted on their assessment.

Even to a naïve novice tutor, it was abundantly clear that the biosciences also polarised opinion among my teaching and clinical colleagues. For every nursing tutor that championed the biosciences, there was another for whom the mere mention of the term “bioscience” produced feelings of fear and dread. During conversations with teaching and clinical colleagues, anecdotal notions, unsubstantiated opinions, accepted theories, and folklore regarding the efficacy of our bioscience teaching and the health of the modern student’s bioscientific knowledge were expressed. For example, professional conversations opined that nurse education had been in steady decline since the collapse of an idyllic mythical golden age, which appears to have existed at any point between the 1960s and early 1990s, during which all students consumed bioscientific knowledge with glee and qualified experts in cardio-respiratory physiology. Contemporary learners, in contrast, possessed lower levels of bioscientific knowledge than their historical predecessors, with nursing care suffering as a result. Often-heard refrains included “these students don’t know anything” and “I wouldn’t have been allowed to get away with that lack of knowledge.” Such opinions, I believe, still surface today, and have been expressed by colleagues from a variety of higher education and healthcare settings, suggesting these beliefs remain within nurse education culture.

Recent teaching experiences continue to suggest that bioscience continues to be a problematic issue for contemporary students and that many of the difficulties students faced at the beginning of my teaching career remain. For example, in the spring of 2021, I found myself assessing students on the MSc Pre-registration Nursing course via an oral exam. One question concerned the pathophysiological rationale for their nursing decisions. Their answers demonstrated good insight into the services and interventions at their disposal and they could also list the physiological observations they would record. However, there was no evidence that they understood the biosciences behind their patient's ill-health. Their explanations and justifications for their decisions were superficial and they were unable to enunciate key medical terms, at times not even attempting to pronounce them correctly. During a tutorial after the assessment, the students made their opinions known in plain terms. "This is too hard" they complained. "There is too much to learn and understand," said one student, and "I get very nervous when I'm asked to discuss biology," said another. I felt defensive and explained that the assessment was authentic, in that it evaluated their understanding of what a qualifying nurse needed to know, to best ensure patient safety and recovery. In response, they reassured me that they were cognisant of this reality, but that did not prevent them from becoming anxious about how to learn everything they needed for qualification. This recent experience served as a further reminder that nursing teachers continue to face challenges when teaching bioscience and therefore, the teaching and learning of the biosciences remains a phenomenon that is ripe for investigation.

1.5.1 The unencumbered student voice – Further reflections of a nurse teacher.

Reflecting on formative teaching and learning experiences served as a clear reminder of how detached I am from the young man that completed his nursing diploma in 1995. In the years between then and the commencement of this thesis I undertook an intellectual evolution such that I no longer recognise his approach towards learning. When thinking about how best to investigate the learning of bioscience it was clear that the best people to listen to would be present day students. However, any notion that I could sympathise or seek to understand their perspective would be futile given how disconnected I had become from the reality of contemporary nurse training. It struck me that I needed to listen to their voice and accept their explanations as their truth as they see it and acknowledge that their experiences would most probably not tally with my own, which will now be tarnished by experience and perhaps no longer representative.

Further reflection led to an analysis of how the student voice is used in nurse education. I was keen to listen to the genuine student voice, unsullied by tutor influence, in a forum in which students were free to express themselves. Traditional data collection methods can arguably stifle expression. Questionnaires, for instance, arguably have a narrow focus. Interviews, even semi-structured, are controlled or facilitated by a researcher and any data generated will be influenced and potentially constrained. I felt that this criticism could be levelled at the research I read in preparation for this thesis. While many authors have sought the student perspective all have chosen traditional data collection methods, which while tried and tested, all arguably could restrain student discussion. I concluded that to best attain an authentic student voice I needed to explore ways to collect unsupervised data. The

unencumbered student voice subsequently became an integral part of this thesis, and all qualitative data analysed within it was collected from unsupervised focus groups, where students controlled the conversation and decided for themselves what to discuss.

1.6 Researching bioscience – Reflections of an academic.

In 2004, I investigated the learning of bioscience for a master's degree dissertation. Through a focus group of tutors, I explored what cardiothoracic physiological principles were considered essential for newly qualified staff nurses, principles that they must understand and appreciate if they are to be able to practice safely. From the results of the focus group, a question paper was devised that asked the students questions on each of the determined principles. The questionnaires were then marked like an exam paper and a percentage grade was awarded for each student. The results were disappointing. The mean score for the whole group (57 students) was 34%, from a range of 10% - 75% (standard deviation 11.36). The median was 30% (Wheeldon, 2004). The resulting hypothesis being that there was a mismatch between tutor expectations and the reality of the students' actual understanding, a finding that correlates with research from Australia (Thorton et al., 1997). In my analysis I highlighted that the teaching and learning of cardiorespiratory bioscience present teachers and clinicians with a conundrum. While it was clear that students wanted to learn bioscience and appreciate its value, they simultaneously regarded the required learning overwhelming and anxiety inducing.

On commencement of this thesis, I returned to the research and opinion that informed my dissertation in 2004 (Akinsanya, 1987a; Akinsanya, 1987b; Courtaney,

1991; Trnobranski, 1993; Jordan, 1994; Wharrad et al.,1994; Clark, 1995; Nicoll & Butler, 1996; Jordan & Reid, 1997; Wynne et al., 1997; Jordan et al., 1999; Campbell & Leathard, 2000; Clancy et al., 2000; Davies et al., 2000; McVicar & Clancy, 2001; McKee, 2002). Several themes emerged as contributory factors to the perceived complexities of the teaching and learning of the biosciences. A common view was that students found learning the biosciences too difficult (Courtenay, 1991; Trnobranski, 1993; Nicoll & Butler, 1996; Jordan et al., 1999) and that more timetable time dedicated to bioscience would alleviate their struggles (Jordan et al., 1999; Davies et al., 2000). The challenge of tackling perceived complex biological topics was for many authors a cause of anxiety in students and staff. Nicoll & Butler (1996), Jordan et al. (1999) and Clancy et al. (2000) for example all asserted that a link exists between the biosciences and student anxiety and Wharrad et al. (1994) found that some tutors lacked confidence when teaching them. McKee (2002) felt that a lack of pre-course science education may explain students' difficulties learning biosciences. Other authors, however, proposed that the perceived complexities were caused by curriculum content. Courtenay (1991) and Clancy et al. (2000), for example, suggested that a switch of emphasis to social sciences at the expense of bioscience explains the lack of bioscience knowledge in qualifying nurses. Whatever the cause there was consensus that nurses were qualifying with sub-optimal levels of bioscience appreciation (Campbell & Leathard, 2000; Clancy et al., 2000).

In addition to the research and opinion discovered while drafting my dissertation, two literature reviews by McVicar et al also proved pivotal. McVicar et al. (2014) and McVicar et al. (2015) provided a gateway into a wealth of research into learning and teaching of bioscience. McVicar et al. (2014) and McVicar et al. (2015) clearly highlighted that the challenges I had experienced as a student, staff

nurse, and tutor were reflected in their evaluation of the state of bioscience education in nursing. Furthermore, their analysis clarified that these challenges were historic with research exploring the learning of bioscience occurring in earnest in the immediate aftermath of Project 2000 (Chapple et al., 1993). Reading McVicar's work and the authors cited within their investigation it became clear that what I referred to as a conundrum in my MSc dissertation was a widely discussed phenomenon. The suggestion that bioscience is too challenging, causes anxiety, and is perceived to be deficient in curriculum time continued beyond 2004 and was a current topic of discussion when I started work on this thesis in 2015. McVicar et al. (2014) and McVicar et al. (2015) hypothesised that within nurse education, there was an accepted belief or received wisdom that although regarded as analogous to the provision of optimal patient care, the learning and teaching of bioscience is challenging for both students and teachers. The causative agents were comparable to the themes uncovered during my MSc work. In particular, the notion that bioscience is considered a source of anxiety among student nurses was still apparent in literature (Gresty & Cotton, 2003; Friedal & Treagust, 2005; Craft et al., 2013) as was a desire for more classroom time (Davis, 2010). Other themes that continued to be a going concern included a lack of pre-course bioscience education (Whyte et al., 2011) and a lack of confidence to teach the biosciences effectively (Freidal & Treagust, 2005).

Another key point inferred by McVicar et al. (2014) and McVicar et al. (2015) was that the notion of inadequacies in bioscience nurse education could be grouped into an over-arching theory or concept, which they referred to as "the bioscience problem." Similar terms had been used prior to their use of this term. Terms such as "the bioscience question," "the biological science problem," and "the bioscience

issue," for example, had all been used before (Jordan et al., 1999; McKee, 2002; McVicar, 2009). However, for McVicar et al. (2015) "the bioscience problem" should be considered a tangible concept that negatively impacted on nurse education. Furthermore, they considered it an historic issue that had been routinely validated or accepted as a truism by research, discussion, and comment in nursing and nurse education literature since the advent of Project 2000. Such notions have been an ever-present topic of discussion in nursing literature, as quoted at the beginning of this chapter "The difficulties that student nurses have in learning human biosciences have given cause for concern for over 20 years, but the problem remains" (McVicar et al., 2015:500).

1.7 Thesis structure.

This thesis is divided into 8 chapters including this introduction. Chapters 2 and 3 review literature in two key areas, the learning and teaching of the biosciences and the notion of the unencumbered student voice as a legitimate method of data collection. Chapter 4 details the research methodology and the execution of the stages of the research project and Chapter 5 describes the findings. The findings are subsequently discussed and analysed in Chapter 6 and the thesis concludes with a discussion on the implications of this thesis on future practice in Chapters 7 and 8.

1.7.1 Chapter 2 – The "bioscience problem": A review of the literature 1991 – 2023.

This thesis starts with an analysis of literature exploring the learning and teaching of the biosciences in nurse education published over the span of my career

in nursing and nurse education. The literature review in Chapter 2 will argue that current and historic literature addressing the learning and teaching of the biosciences, while still cited in contemporary literature, is nevertheless out-dated. Furthermore, Chapter 2 will also argue that there is a lack of qualitative data into the experiences of student nurses from the United Kingdom (UK), which results in a need for further exploration of how contemporary students working in the National Health Service (NHS) approach and consider their learning of the biosciences.

1.7.2 Chapter 3 - The unencumbered student voice: A humanistic method for accessing the authentic student perspective.

Chapter 3 explores the philosophical influences that underpin this thesis and informed the data collection and analysis. It deliberates how a trio of humanistic theories, namely humanism, humanistic psychology, and humanistic research influenced the decision to access the unencumbered student voice. As this chapter will argue, this approach is an attempt to pay close attention to the principle of unconditional positive regard and treat data as undisputable truths, irrespective of the viewpoint. Furthermore, allowing students the freedom to express themselves in unsupervised forums, safe from tutor interference is a legitimate way to ensure access to these undisputable truths and the hitherto unheard student voice. Chapter 3 also lays bare the professional as well as ontological influences that informed this research to foster fidelity and ensure authenticity in the interpretation of data.

1.7.3 Chapter 4 - Research methodology and methods of data collection.

Chapter 4 starts with a justification for an interpretive phenomenological approach. It contains a detailed description of the research design and its execution.

To answer both research questions a mixed methods approach was taken, and this chapter defends that decision and argues that quantitative data was best suited to answer research question 1, whereas qualitative data was appropriate for research question 2. In seeking to answer research question 1 a questionnaire was devised and distributed to 164 3rd-year student nurses in the first phase of the research. This chapter will defend the use of a questionnaire and the convenience sample that completed it. In the qualitative unsupervised focus groups were used to gather data, free from tutor interference. This chapter also defends the use of focus groups and why they were appropriate for this study.

1.7.4 Chapter 5 - The questionnaire and focus groups: A description of the findings.

This chapter describes the study findings and the extent to which the research questions have been answered. It commences with an analysis of the findings of the pilot study, before describing the questionnaire and the focus group findings. The chapter concludes that the questionnaire data measures the extent to which student concerns about the biosciences remain for a contemporary group of students in terms of anxiety, perceived complexity, and classroom time, and thus answer research question 1. It further argues that this group of students value the biosciences and maintain they are integral to patient care. The focus group findings are scrutinised in terms effectiveness with an analysis each group's idiosyncrasies, pitfalls, and anomalies. The chapter concludes that the qualitative data suggests six major concepts that encapsulate students' perspectives of the biosciences.

Concept 1: *Indispensability* – the truism that an understanding of the bioscience is a prerequisite for safe and effective nursing care.

Concept 2: *Deficiency* – the perception that the provision of bioscience in the curriculum is deficient in that it does not meet their expectations.

Concept 3: *Burden* - the perception that learning the biosciences is burdensome and arduous, and that the amount of knowledge required is insurmountable.

Concept 4: *Angst* – the belief that learning and using bioscience causes anxiety and stress.

Concept 5: *Reality* - the notion that learning bioscience in the reality of clinical practice is problematic and can adversely affect their understanding.

Concept 6: *Identity* – students assume different identities depending on their situation. These assumed identities impact on their learning of the biosciences.

1.7.5 Chapter 6 – Discussion: The perspectives and experiences of adult-field student nurses learning bioscience.

Chapter 6 further explores the six concepts that encapsulate the students' perspectives of the bioscience and argue that there are two paradoxes that impact bioscience education. Firstly, a "value and discomfort" paradox exists that impacts on the ability of students to learn bioscience in classroom settings. Secondly, a "value and the reality of nursing practice" paradox impacts on their ability to learn bioscience in clinical settings. The term paradox is used to reflect a tension between the high value placed on the biosciences and the struggles students encounter while trying to master them. This chapter is an attempt to address the extent to which research question 2 has been answered while simultaneously attempting to identify the impacts of these paradoxes and the potential changes that are required not only in the classroom but in practice also.

1.7.6 Chapter 7 – Limitations and recommendations.

This chapter recognises the limitations of this research and recommends that repeating the questionnaire and focus groups with a different sample in a modern context could strengthen the research findings. Potential pedagogical solutions to the “value and discomfort” paradox are discussed in terms of possibilities for future research. This chapter also explores why a symbiotic bipartisan approach to bioscience education in clinical practice could be challenging and recommends closer working relationships between academics and clinicians seeking to counter the “value and reality of clinical practice” paradox.

1.7.7 Chapter 8 – Conclusions.

The concluding chapter summarises the thesis and its findings. It also includes a reflective summary of the journey undertaken from initial ideas to the completed thesis and its recommendations. The thesis then concludes with a discussion on the impact of the thesis findings on how nurse educators can use a better understanding of the student nurse learning experience when working with undergraduates. Finally, this thesis will discuss how the experiences of completing this research could inspire others to better utilise the unencumbered student voice to research nurse education and seek feedback on course structure.

Chapter 2

The “bioscience problem”: A review of the literature 1991 – 2023

This chapter will examine literature published between 1991 and 2023 that explored or analysed the teaching of the biosciences to student nurses. A range of literature is examined, including research, comment, and analysis, published in peer reviewed nursing journals in the UK, Australia, New Zealand, South Africa, and Ireland. The main discussion will focus on examining the perceived wisdom that the teaching of the biosciences in nurse education is fundamentally flawed, a phenomenon commonly referred to as the “bioscience problem.” It will conclude that the notion that the “bioscience problem” leads to nurses qualifying with an inadequate level of understanding of the bioscience is based in out-of-date evidence that was mainly conducted overseas and lacking in a qualitative perspective of the student experience.

The “bioscience problem” is an amalgam of disparate perceived inadequacies and is, arguably, a nebulous theory. This chapter will identify the key themes associated with the concept of educational inadequacy from the perspectives of students, tutors, and qualified nurses. The literature is analysed in the context of a typical student journey and examines related and influencing theories that highlight the impact of the perceived complexities on education and practice. The narrative being that students commence nurse training without an acceptable grounding in the biosciences, are then taught by tutors that lack confidence in their ability to teach them and work in an anti-bioscientific education culture that favours the social sciences. Simultaneously, students find the learning of biosciences in perceived

short periods of time difficult and anxiety inducing. Consequently, they qualify with insufficient knowledge, a lack of confidence, and an inability to teach the students that follow them.

2.1 The search strategy.

This section seeks to describe the systematic literature search undertaken and therefore reassure the reader that the literature discussed within this chapter was obtained via a rigorous process. The term systematic in this context is based on the assertion by Hewitt-Taylor (2017) who argues that a systematic literature review is one that follows a logical process that eliminates unexplained gaps. This will help counter any criticisms of bias as the search process is laid bare. As Roush (2023) highlights, being explicit about the systematic process used will avoid any criticisms of cherry-picking research or predisposition.

A broad literature search was conducted to access research and discussion on the teaching and learning of the biosciences between the advent of Project 2000 and the present day (i.e., 1991 – 2023). This period would reflect my own nursing career and facilitate exploration of the notion that the teaching and learning of the biosciences became problematic around the same time.

The search strategy followed two phases. In the first phase the CINAHL and MEDLINE data bases were explored using the key words and Boolean operators detailed in box 2.1. The searches were restricted to the presence of the search terms in the title or the abstract, articles written in English, and published in academic journals. A total of 24,999 articles were found at this initial stage. Applying

the major subject headings detailed in Box 2.2 reduced the number of articles to 7502.

Box 2.1 – Key words and Boolean operators used in the literature search.

bioscience* OR science OR anatomy OR physiology OR biolog* AND nurs* OR student* AND education OR pre-registration OR undergraduate.

Box 2.2 – Major subject headings used in the literature search.

curriculum,

students, nursing,

education, nursing,

anatomy,

education, nursing, baccalaureate,

teaching,

learning,

science,

physiology,

students, undergraduate,

biology,

nurses,

students, nursing, baccalaureate,

education, nursing, graduate, faculty, nursing, biological science disciplines.

In the second phase a further search of the British Nursing Index (BNI) using the same parameters, keywords, and major subject headings was undertaken. This search yielded a further 215 articles, producing a total of 7,717 articles for consideration.

Articles that did not relate to nursing or nurse education were rejected as were any papers that did not have explicit relevance to the teaching and learning of the biosciences. After duplicates were discounted, 88 articles were identified as relevant and were considered for inclusion. Of the 88 selected articles, 49 were primary research projects, which explored the student nurse experience of learning bioscience.

2.2 Defining bioscience.

There is little consensus on the accepted nomenclature of the human biology that underpins nursing practice with many terms used interchangeably. This section explains why the term “bioscience” has been used in this thesis.

Life science, physical science, biological sciences, bioscience knowledge, and bionursing have been used to describe the science that informs nursing practice. However, a historical exploration of how the scientific underpinnings of nurse education have evolved in recent decades reveals a clearer explanation of what is

meant by the term bioscience in a modern context. Wilson (1975) postulated that the science of nursing is composed of the behavioural sciences and biological sciences. The behavioural sciences include psychology, sociology, and social anthropology while the biological sciences encompass physiology, pharmacology, microbiology, and anatomy. Montague (1981), however, argued that attempts to define what constitutes the biological sciences are problematic given the range of subject matter that constitutes biology as a body of knowledge. Anatomy, argued Montague (1981), includes topics such as histology and cytology; physiology encompasses a wide range of specialisms, for example, cardiology, neurophysiology, and respiratory physiology; microbiology includes bacteriology and virology. In the same volume, Boore (1981) argued the case for the inclusion of the physical sciences, citing gas laws, such as hypothesised by Boyle and Fick, as essential elements of nursing science as they help explain pulmonary ventilation and internal and external respiration, all key physiological phenomena that inform nursing assessments. Akinsanya (1987a) maintained that nursing relied heavily on the medical profession to determine the content of basic science in its training programmes. In many instances, in the 1970s and 1980s, doctors taught bioscience to nurses, in classroom settings, using a medical model focus. As a result, the content of the lesson did not relate to the reality of nursing practice. In response, Akinsanya proposed a new teaching concept, entitled bionursing, with the explicit aim of ensuring all biological content aligned to nursing practice (Akinsanya, 1987a). In terms of defining bioscience for nursing practice, the bionursing model is considered a pioneering step toward embedding nursing-orientated bioscience into the modern post-project-2000 curriculum (Trnobranski, 1993; Kyriacos et al., 2005). Although nursing swiftly moved away from a task-orientated role in favour of

independent autonomous practice, Akinsanya's principle of "bionursing" still underpins approaches to the teaching of basic science in the modern curriculum, in that students require an overview of the bio-scientific principles that inform nursing decisions rather than an overview of several discrete scientific disciplines (Casey, 1996; Davis, 2010). It is, however, the move into "all graduate" professional status in 2010 that generated the clearest guidance to date on what subjects constitute the science that underpins nursing practice. The 2010 Nursing and Midwifery Council (NMC) Standards for Pre-registration Nursing Education stipulated that the curriculum should be equally divided into nursing theory, basic science, social science, and nursing instruction. The basic science topics specified were:

- anatomy and physiology,
- pathology,
- bacteriology,
- virology,
- parasitology,
- biophysics,
- biochemistry and radiology,
- dietetics,
- hygiene,
- pharmacology (NMC, 2010).

In contemporary nursing academia, bioscience has become the accepted catch-all term for the science that underpinnings nursing practice (Taylor et al., 2016). For clarity and having considered the historical and academic discourses

around this subject, the word bioscience will be used as an umbrella term for all the subjects listed above.

2.3 Theme 1: Inadequate preparation - Students commence nursing courses with an inadequate grounding in the biosciences.

While historical evidence suggested there was no link between studying biology at school and success in bioscience in nurse education (Ofori, 2000) research from Ireland and Australia proposes there is a link between pre-registration bioscience learning and success in nursing bioscience assessments. McKee (2002) and Whyte et al. (2011) used assessment grades to confirm a correlation between previous biological study and success in biology-based nursing assessments, although neither study seeks to explain why this is the case. The argument that previous bioscience learning, e.g., a GCSE in biology, enhances under-graduate learning is logical and the data generated by McKee (2002) and Whyte et al. (2011) appears to validate that perspective. In the UK applicants to nursing degree courses do not need any qualifications in science-based topics. Entry-criteria is based on the University and College Admission Service (UCAS) tariff points, determined by individual universities, and the standards set by the NMC (NMC, 2018b). Current standards for recruitment to pre-registration courses are based on nursing values, as described by the NMC Code of Conduct (NMC, 2018a), and not on prior experience or education. Therefore, concerns that a lack of instruction on biosciences before commencement of nurse training adds weight to the notion that some students may be ill-prepared for the level of bioscience learning required for nursing practice.

However, while a commonly cited concern, there is scant evidence that little or no prior bioscience study is an issue in the UK. McKee (2002) and Whyte et al. (2011), for example, examined the performance of students in Ireland and Australia, respectively. Andrew (1998) explored self-efficacy with science in student nurses and discovered that students with prior learning in bioscience expressed they had greater confidence when solving science-based problems. While this evidence has been widely cited (McVicar et al., 2014; McVicar et al., 2015; Whyte et al., 2011) the tests used to assess confidence are based on everyday science situations rather than human biology. Contemporary studies by Gordon et al. (2017) and Owens (2020) also sought to establish a link between a lack of pre-nursing bioscience education and ability to learn nursing bioscience. Gordon et al. (2017) used questionnaire data to explore links between previous study and confidence in biology. Their data indicated that anxiety concerning bioscience is greater in students with little or no educational background in bioscience. Owens (2020) audited the impact of a 5-day pre-course study intervention. They explored the grades of their students' final bioscience assessment and found that the students with no prior bioscience learning who completed the 5-day pre-course study performed just as well as students who had studied bioscience at school. The implication being that without the 5-day course those students would have struggled, thereby proving the notion that a link exists between a lack of pre-nursing bioscience and difficulties in mastering them during training. Nevertheless, both studies were executed in Australia, rather than the UK and, therefore, there remains no tangible evidence that a lack of prior bioscience education has been an issue for UK HEIs, despite popular opinion that it has (McVicar et al., 2014; McVicar et al., 2015).

2.4 Theme 2: Ineffective tutors - tutors lack confidence in their ability to teach bioscience.

The notion that nursing lecturers lack confidence in teaching bioscience is long-standing (Courtenay, 1991). However, historically concerns were focused on the utilisation of non-nursing tutors to teach bioscience, which risked bioscience lessons omitting a nursing perspective or application to care (Wharrad et al., 1994). The paucity of contemporary evidence exploring the nurse tutor perspective suggests that this aspect of the bioscience problem is out-dated and not a concern for modern Higher Education Institutions. The most recent research that explores the tutor perspective, does, however, suggest that for many nurse tutors, teaching bioscience does cause concerns and can be viewed as problematic (Friedal & Treagust, 2005). In their questionnaire study, Friedal & Treagust (2005), compared the attitudes and perspectives of students and tutors towards bioscience and its relevance to nursing practice. As expected, the mean confidence in their bioscience knowledge was higher for staff than it was for students. However, confidence levels in staff were only marginally higher. Using a rating scale from 1 to 5, with 5 being “very confident”, the students had a mean confidence level of 3.47, whereas the mean confidence level for staff was 3.7. As Friedal & Treagust (2005) highlight, while the mean is higher, the difference between them was not statistically significant. Furthermore, they argue, given that the ideal confidence level for a member of staff is 5, the levels of confidence in bioscience knowledge, expressed by this group of tutors was worrying. Moreover, almost half of nurse tutors who participated agreed or strongly agreed that their knowledge and understanding of biosciences was not good enough to appreciate all the bioscience principles that inform nursing practice (Friedal & Treagust, 2005). Given the age of this data, and

the changes that have occurred in nurse education in the UK in the past decade, the validity of these findings is questionable. Nevertheless, later research did suggest that tutor reluctance to teach the biosciences still existed in 2015. Questionnaire data from members of Bioscience in Nurse Education (BiNE) group (specialist reference group of Higher Education Academy) highlighted that many members believed that a proportion of nurse teachers remained reluctant to teach the biosciences, lacked the knowledge to convey correct biological information, or considered the biosciences as irrelevant (Taylor et al., 2015). These findings add weight to the notion that the "bioscience problem" remains an issue for teachers as well as learners.

2.5 Theme 3: Biased curricula - there is a perceived educational bias against the biosciences.

Research suggests that within nurse education there has been a historical bias against the biosciences in favour of the social sciences (Courtenay, 1991; Jordan, 1998; Clancy et al, 2000; Manias & Bullock, 2003) and this viewpoint remains in contemporary literature (Perkins, 2019). This perceived notion suggests that nurse education has been subject to a battle of supremacy between bioscience and social science, in which both compete to be the discipline with the greatest influence on nursing theory (Courtenay, 2002). In the 1980s, Akinsanya (1987a) argued that traditional reliance on a medical model for teaching bioscience, in classes often taught by members of the medical profession, devalued nurse education. Furthermore, this reliance on the medical model as a framework for the teaching of bioscience reinforced the view that nurses were subordinate to doctors, merely following medical instructions and executing simple nursing tasks rather than

being autonomous professional practitioners capable of making informed decisions. The move into higher education and the advent of Project 2000 sought to counteract this perceived bias by pursuing professional autonomy through the creation of a scientific base for nursing practice. Nursing curricula aimed to produce intelligent, independent, thinking practitioners, with an enhanced professional identity reinforced by their own bespoke body of knowledge or science of nursing (Trnobranski, 1993). However, a major criticism of the move to a new theoretical scientific basis for the nursing profession was that its fundamental ethos was psychosocial, resulting in nurse education witnessing a shift of emphasis away from bioscience towards social science (Courtenay, 2002). Social science is and remains a vital element of nurse education (Cooke, 1993), however, traditionally such was the dominance of biology within nurse training that psychology and sociology were all but excluded from taught theory sessions and not held in high regard. In nursing's attempts to create a holistic knowledge base for practice, greater emphasis was placed on the social sciences to redress the balance. The argument, however, is that while the increase of social science in nurse education was welcome the pendulum swung too far with the biosciences being marginalised as a result (Clarke, 1995).

However, while a commonly expressed view (Perkins, 2019), there is little empirical evidence to support it. Research often cited as evidence of partiality towards social sciences highlights preferences rather than bias. Courtenay (1991) for instance found that students prefer to learn bioscience rather than social science. They also found the opposite to be true in tutors. However, this only highlights preferences for topics rather than an actual bias among tutors to enhance focus on one subject area over another. This is reflected in subsequent studies also cited as evidence of social science bias. Trnobranski (1996) for instance, found that all the

respondents in their study favoured the social sciences over bioscience, the opposite of Courtenay (1991). But, once again, this is a preference rather than partiality. A large multi-centre study by Clancy et al. (2000) suggested that students felt there was slightly less educational input on bioscience than for social sciences, but slightly less education input may not constitute bias. Trnobranski (1996) also discovered that tutors tended to toe the line, in that they overemphasised the importance of their specialty at the expense of others and that there was evidence of tension and competition among academics who jockey for emphasis in taught content. One could also argue that the historical lack of an established and clearly defined knowledge base for nursing fosters such a situation. Rather than an actual phenomenon, the perceived bias towards the social sciences is just that, a perception. However, the presence of such a perspective may exacerbate the concept of a "bioscience problem," even if its influence is negligible.

While the philosophy of a holistic nursing knowledge base incorporating the social and biological aspects of care is sound, some argue that the biological sciences became an adjunct or addition rather than an integral part of an integrated approach (Clarke, 1995; Wynne et al., 1997; Clancy et al., 2000). This in part has been posited as a reaction against the perceived reductionist ethos of the biological sciences. Historically, nursing tolerated a deferential relationship with the medical profession, in which doctors asserted a degree of control. The move toward a more holistic knowledge base and the promotion of the social sciences was an attempt to shed nursing's "handmaiden" image and assert itself as a distinct science-based healthcare profession (Smith, 1981; Jordan, 1994). The biological sciences were widely regarded as analogous to the medical model and medicine and therefore were treated with a degree of disrespect. Furthermore, the medical model embraces

the reductionist perspective that people in need of healthcare are simply experiencing reversible biological or pathological disturbances. This view contradicts the central principle of nursing in which people are treated as individuals. Individuals are complex and have social, psychological, and emotional needs and are so much more than the malady they live with. The medical model, and therefore bioscience by association, is more concerned with cure or diagnosis, rather than care for heart, mind, and soul and as a result devalues the emotional aspects of nursing care (Jordan, 1994; Trnobranski, 1996; Cox, 2004; Logan & Angel 2011). After all, nurses primarily exist to care, and no amount of bioscience knowledge will ensure a patient is comfortable. This outlook is best expressed by the following quote from the Nursing Times in 1981.

"It matters very little whether or not the nurse understands the physiology of the chloride shift to care for a patient with respiratory distress. What are necessary are basic common sense and the ability to soothe and reassure. It's for doctors to provide the rest" (Holford 1981, cited in Trnobranski, 1993: 495).

Nevertheless, the recoil from a disease-orientated and reductionist medical paradigm and the resultant disenfranchisement of the biosciences, although unintentional, did lead to narrowed and constricted bioscience focus within nursing curricula in the 1990s (Wynne et al., 1997).

Medicine versus nursing tension may also further explain the perceived bias of the social sciences at the expense of bioscience. Jordan (1994) contended that the logical and rational nature of science was at odds with the student nurse's more intuitive thinking style. Gender may also play a crucial role. Wynne et al. (1997) argued that female nursing students were more likely to favour the social sciences over the biological. Their evidence for this claim rests on a historic analysis that

young women were culturally discouraged from pursuing activities that fostered interests in scientific and mathematical thought, such as engineering (Aldrich, 1978 cited in Wynne et al., 1997: 471). This contention in a modern context is controversial, however, given that as a student nurse 90% of my peers were female and conversely in the 1990s medicine remained a male-dominated profession. In a historical sense this argument had a degree of merit.

Another argument for a philosophical shift away from biosciences is that they became devalued or discredited by nurses and academics alike. During the 1970s and 1980s the provision of bioscience was considered haphazard, ill-defined, and unstructured, and not only were nursing academics concentrating on psychosocial research, very few of them were taking degrees in science-based subjects (Wilson, 1975; Clarke, 1995; Friedel & Treagust, 2005). Consequently, tutors felt their knowledge and understanding of the biosciences were inadequate, which led to reports of anxiety and a lack of confidence when teaching complex biological concepts that contributed to a reduction in the quality of teaching (Courtenay, 1991; Friedel & Treagust, 2005). A lack of nurse tutors with qualifications in a bioscience subject also resulted in student nurses being taught by other health professionals. A combination of both these factors undermined the status of the biosciences in nurse education. Especially for students taught by non-nursing staff, whose experience led to a disconnect between biology and its influence on nursing care (Jordan, 1994).

A lack of empirical evidence regarding the efficacy of bioscience in terms of its enhancement of nursing care exacerbated antagonism towards the biosciences and further diminished its status. While the need for bioscience instruction in nurse education may seem self-evident, there is no sound research basis for it. Neither is there any evidence that nurses retain and use their bioscience knowledge after

qualification. Indeed, in their seminal research, Wilson (1975) concluded that the staff nurses in their study demonstrated little understanding of the biosciences and that their level of knowledge did not match the expectations of the medical team, who largely expected their nursing colleagues to have a much greater level of understanding of the biological sciences and their application to care.

Irrespective of which direction the pedagogical pendulum swings, however, the instruction from the NMC is clear; bioscience alongside nursing theory, social science, and clinical instruction, is an integral element of the modern nursing degree (NMC, 2010;2018b).

2.6 Theme 4: Complexity - student nurses feel bioscience is difficult in comparison to other nursing subjects.

The belief that student nurses find learning bioscience difficult is historic (Akinsanya, 1987b). The extent of these difficulties has also been argued as a reason for students to leave nursing courses (Davies et al., 2000; Jordan et al., 2000; Andrew et al., 2008), with authors citing White et al. (1999) who found that students placed “too much science” in their top five reasons for leaving nursing before qualification. However, this conviction is arguably a tutor construct based on exam results and personal observations (Wharrad et al., 1994; Mhlongo & Masango, 2020). There have been, however, research studies that have sought to determine the student perspective. Caon & Treagust (1993), for example, used a questionnaire to assess 6 hypotheses about students’ attitudes and perspectives towards bioscience. One hypothesis proposed that nursing students perceive their science studies to be difficult. Caon & Treagust (1993) divided 197 nursing students into

three groups, successful, middle, and unsuccessful, with allocation dependent on student success in their bioscience exam. As expected, a majority of the successful group (58%) felt that the difficulty of the bioscience lessons was “about right” or easier, while 90% of students allocated to the unsuccessful group stated that the bioscience lessons were “much too difficult” or “somewhat difficult.” Of the “middle” group, 72%, rated their bioscience lessons as being “much too difficult” or “somewhat difficult.” Interestingly, the middle group comprised 67.5% (133 students), and only 17% (34 students) were allocated to the “successful” group, therefore providing compelling data on students’ perspectives of perceived complexity. The study by Caon and Treagust (1993) is compelling given its large sample size but is arguably outdated, despite being cited as evidence of students’ difficulties with bioscience subjects by contemporary authors (Owens, 2020; Swaim et al., 2022).

Similar findings are apparent in qualitative data analysed by Chapple et al. (1993). Analysis of data from semi-structured interviews with nursing students produced a picture of learners unsatisfied with their bioscience education, especially in terms of complexity, with students complaining that bioscience lessons were too detailed to the extent that some found them overwhelming, with taught content “going over their head.” Again, these findings are historic, but research conducted in the past 10 years reinforces the notion that students find bioscience too difficult and too complex. Gordon et al. (2017) used survey data from 126 students to assess their students’ perspectives on bioscience and its impact on their education and the results provide tangible evidence that a sizeable portion of nursing students find bioscience challenging and difficult to learn. For example, when posed with the question “Bioscience units are the most difficult that I am undertaking in my course”

only 43% disagreed, and 40% agreed with the statement “Bioscience is harder than my nursing subjects.” Craft et al. (2016) saw comparable results through their analysis of reflections by 22 qualified nurses. Staff nurses were asked to reflect on aspects of their nurse education and two-thirds of respondents stated that bioscience had been the most difficult part of their nurse education, with a similar number claiming that bioscience was more burdensome than other, nursing skills based, modules (Craft et al., 2016).

Earlier studies explored the relationship bioscience enjoys with other aspects of the curriculum. The hypothesis being that students consider bioscience to be the most difficult and challenging aspect of their training. Jordan et al. (1999) used qualitative and quantitative data to explore the level of difficulty students experience when learning bioscience, especially in comparison other topics. Only “research” and “critical thinking,” were considered harder than bioscience by a majority. In all other instances, most students felt bioscience was tougher and more difficult. For instance, 74% of students considered bioscience to be more challenging than nursing concepts, and 66% felt bioscience was harder than sociology. Survey data gathered by Gresty & Cotton (2003), found that their students also ranked bioscience as the most difficult subject in their curriculum, followed by psychology, nursing theory, and sociology. This evidence is over twenty years old but still informs the debate on the bioscience problem with both research studies being cited as evidence that students find the biosciences difficult in contemporary studies (Gordon et al., 2017; Horiuchi-Hirose et al., 2023; Madhuvu et al., 2022).

2.7 Theme 5: Anxiety - the challenge of learning bioscience is a source of anxiety for nursing students.

The claim that bioscience causes anxiety among student nurses is endemic in the literature and has a long history (Nicoll & Butler, 1996; Jordan et al., 1999; Clancy et al., 2000; McKee, 2002; Gresty & Cotton, 2003; Andrew et al., 2008; Craft et al., 2013; Mortimer-Jones et al., 2018). However, evidence to suggest a direct link between the challenge of learning bioscience and anxiety is limited and for a time, the notion that students found learning bioscience anxiety-inducing was theoretical and anecdotal.

The work of Nicoll & Butler (1996) is often cited as evidence of a causative link between bioscience and anxiety and continues to be used as a key piece of evidence (Mortimer-Jones et al., 2018: Reynolds et al., 2022). However, their research explores potential solutions for anxiety and does not seek to establish that the anxiety exists. Rather, their work starts with the premise that students find bioscience anxiety-inducing an assumption they based on a “gnawing and growing awareness of a problem with learning biology at our college” (Nicoll & Butler, 1996: 616). They also acknowledge a lack of evidence for their hypothesis but do cite Sutcliffe (1993), another much-cited author (Jordan et al., 1999; Clancy et al., 2000; Davies et al., 2000; Gresty & Cotton, 2003) whose research also only suggests anxiety may exist rather than it being a tangible phenomenon. Furthermore, Sutcliffe’s study explored learning styles rather than the learning of bioscience (Sutcliffe, 1993).

The notion that bioscience causing anxiety is an established fact is reflected in other published research articles (Jordan et al., 1999; Clancy et al., 2000; Friedal & Treagust, 2005). However, each of these projects uses anxiety and associated

words, interchangeably. Jordan et al. (1999), for example, refers to difficulty rather than explicitly anxiety, the work of Clancy et al. (2000) focuses on confidence, and Friedal & Treagust (2005) discuss “worry” because of learning bioscience. While confidence, worry, and difficulty can all contribute to anxiety, they can also all exist separately and do not necessarily lead to or cause anxiety. Nevertheless, it could be argued that authors have used anxiety as an adjective to describe a sense of worry or concern, rather than suggesting a diagnosable and treatable disorder (such as General Anxiety Disorder (GAD)). Furthermore, colloquially, anxiety refers to feelings of nervousness, worry, concern, unease, apprehension, disquiet, and angst. Therefore, the term anxiety is a suitable universal term that students and nursing staff can relate to. While these studies do not establish a link between bioscience and anxiety, the findings of each of these studies does strongly suggest that student nurses experience difficulties with learning bioscience and that these difficulties are considered troublesome.

Two studies explicitly use the term anxiety when trying to establish a link between worry and concern and the biosciences. Gresty & Cotton (2003) asked UK-based students to indicate on a scale of 1 – 5 how a range of nursing subjects ranked in terms of “difficulty”, “anxiety”, and “confidence in passing”. In relation to anxiety, 1 indicated “no anxiety”, and 5 represented “very anxious”. Bioscience was ranked the highest in terms of anxiety and difficulty, suggesting that for this group of students there was a relationship between bioscience and anxiety, albeit from a small sample of students (n=65). Australian-based research also provides evidence of a link between bioscience and anxiety. Craft et al. (2013), used a Likert scale to assess the perceptions of student nurses towards their learning of bioscience. In addition to questions on subject difficulty and confidence, the students were

specifically asked if they were anxious about studying bioscience. Over half (56%) agreed or strongly agreed with this statement, with only 18% disagreeing or strongly disagreeing. However, this study was based on students just commencing their course that had not yet studied bioscience. Therefore, this evidence does not prove the hypothesis that bioscience causes anxiety, rather it is the prospect of studying it that might.

Contemporary evidence, however, calls into question the findings of Gresty and Cotton (2003) and Craft et al. (2013). Research by Mortimer-Jones et al. (2018) suggests that their students were no more anxious about bioscience than they were about other aspects of the curriculum. To ascertain levels of anxiety, 188 students were asked to complete a State Trait Anxiety Inventory (STAI) test (Marteau & Bekker, 1992), in relation to three subjects, at regular intervals during one semester. The results indicated no significant differences in levels of anxiety between bioscience and subjects called contemporary nursing practice and transition to nursing studies. Mortimer-Jones et al. (2018) use a recognised measure of anxiety to evaluate their hypothesis and, therefore, this research is a literal measure of diagnosable anxiety, rather than an assessment of anxiety as a colloquial description of a range of common feelings associated with worry and concern. This may explain the lack of significant difference, in that the STAI test measures anxiety as a mental health issue, rather than how troublesome or concerning something is. Furthermore, taken as a literal assessment of anxiety, the mean scores for all three nursing subjects' range between 13.94 and 16.25, and given that scores between 10 and 18 on a STAI test indicate mild to moderate anxiety, suggests that this group of students found all study anxiety-inducing.

While the evidence for a direct link between studying bioscience and anxiety is imprecise, and notions of anxiety are not clearly defined, the idea that a definite link between anxiety and bioscience remains a topic for discussion in contemporary nursing literature (Owens, 2020; Barton et al., 2021). There is, therefore, a need for further research to establish a causative link between feelings associated with anxiety and the learning of bioscience.

2.8 Theme 6: Lack of classroom time – timetables do not meet nursing students' expectations.

The view that student nurses would prefer an increased amount of classroom time dedicated to the biosciences is a widely accepted stance (McVicar et al., 2015) and there is evidence from the student, tutor, and qualified nurse perspective to confirm this is a universal position. Nicoll & Butler (1996) in their research into quelling student anxiety proposed enhanced classroom times as a potential solution. The students interviewed suggested that because bioscience contains an overwhelming volume of information, it follows that more time should be dedicated to teaching it. Jordan et al. (1999) three years later reinforced this view. Questionnaire data from 339 students over the course of 18 months consistently showed that the students felt that too little time had been dedicated to bioscience. Students were asked about time dedicated to bioscience on four occasions and each time a majority (51%, 78%, 71%, and 82%) stated that too little classroom time had been devoted to the biosciences. Jordan et al. (1999) explained that this group of students felt that the classroom time fell short of their expectations claiming respondents stated, "for such an important subject, I felt it (bioscience) was pushed into a short space of time" (Jordan et al., 1999:218). In 2005, Friedel and Treagust

found an overwhelming majority of students believed that not enough curriculum time had been allocated to the bioscience (Friedel & Treagust, 2005). A Likert scale was used to gauge the opinions of 155 nursing students, and 81.2% of respondents agreed or strongly agreed with the statement “I believe there should be more nursing-related science as part of the nursing programme.” Furthermore, 75.8%, disagreed or strongly disagreed with the statement “There is too much classroom time allocated to bioscience subjects….”

Once qualified, nurses take a similar view. Davis (2010) found that 57.1% of their sample of qualified nurses answered “content was limited” in response to the question. “How extensive was the bioscience content of your pre-registration course.” This is a more compelling statistic given that qualified nurses are arguably better placed to assess the level of knowledge required for autonomous clinical practice. Taylor et al. (2015) audited the time dedicated to bioscience in nursing programmes offered by 10 Higher Education Institutes. Through interviews they ascertained that the proportion of curriculum hours dedicated to the biosciences was between 0.4 – 2.4% of 4600 hours of learning. Given than 2300 hours of a pre-registration nursing course is dedicated to clinical practice, these estimates are much lower than the reality. However, their central argument is that their calculation represents an inadequate amount of classroom time spent learning bioscience. This claim is made without any proposal for what would constitute an adequate amount of time but does suggest too little time is ringfenced for nursing associated bioscience. Certainly, the tutors participating in this study felt that the biosciences were not prioritised, as one respondent highlighted “There is not enough classroom time dedicated to teaching bioscience…As it is highly conceptual, it needs to be explained, and related to clinical practice” (Taylor et al., 2015:2800).

Recent data suggests that for modern students there remains a lack of classroom time dedicated to the biosciences. Mhlongo & Masango (2020) collected quantitative data from 114 2nd year nursing students to explain the recent inferior performance in bioscience-based assessments. They identified four reasons that explained their disappointing results from a student perspective, which were poor teaching, language barriers, a lack of tutorials, and a short study period before the assessment. The latter two causes arguably relate to a lack of curriculum allocation to the biosciences. These results reflect the feelings expressed by 18 students interviewed about their experiences of their whole nursing curriculum (Morrell-Scott, 2019). In their thematic analysis Morrell-Scott (2019:154) identified a theme they entitled “Can we have some more?” which described the desire among first year students to spend more time in the classroom studying the biosciences. The consensus being that more bioscience study would enable them to prepare better for clinical practice.

There appears to be an accepted notion that extra tuition or larger amounts of classroom time equates with academic success. Private tuition, for example, is commonly used by parents as a method of enhancing a child’s academic potential (Hajar, 2020) despite little evidence of its effectiveness (Hof, 2014). Given the popularity of this ideal it should, perhaps, be no surprise that this perspective is reflected in the student population. The argument that greater classroom time would enhance the learning of bioscience, therefore, has a reasonable logic to it. Arguably, this logic has a degree of substance as recent research suggests that extra classroom time, especially early in nursing courses, will enhance learning in terms of both confidence and academic performance. Owens & Moroney (2017) assessed two approaches to enhancing classroom time, a 60-minute weekly tutorial, and an

on-line self-directed learning platform. Students that engaged in one of these initiatives achieved increased grades in bioscience-based assessments. Further research established that not only did extra time enhance academic performance, but it also raised confidence in mastering bioscience in student nurses (Owens, 2020).

2.9 Theme 7: Value - bioscience is highly valued and seen as vital to patient care.

Despite concerns about the quality of bioscience education academics have continually maintained that students place a high value on the biosciences and their place in their education and practice. However, while this appears to be an accepted premise the evidence for this claim is arguably patchy and, in many instances, historic. Thornton (1997) and Prowse and Lyne (2000) found that students completing their nursing BSc clearly indicated that they valued bioscience and its influence on their practice. However, these studies are historic and in the case of Thornton (1997) quite vague in terms of how data was collected. More compelling quantitative evidence, however, does provide clarity on the question of value, albeit from historic sources (Jordan & Hughes, 1998; Jordan et al., 1999; Clancy et al., 2000; Friedal & Treagust, 2005). Jordan et al. (1999) used a survey to evaluate the opinion of 285 students and 57 tutors on the learning and teaching of the biosciences. However, while their large sample of students provides some rigour, this study does not provide any insight into why students value the biosciences, therefore it only provides a rather one-dimensional view. Likewise, Clancy et al. (2000), in their study of bioscience knowledge in the care of upper respiratory tract infection had a positive response to their survey question “In your view, how

important is a knowledge of human biology (i.e., physiology, anatomy, etc) to your practice" (Clancy et al., 2000:1525). However, while there was a large sample of students (153), this positive response comes without insight into the reasons for their satisfaction. Friedal & Treagust (2005) also used survey data to determine that students value the biosciences as part of their education, with 80.6% of students agreeing with the statement "I believe that bioscience knowledge forms the basis of nursing practice" and 96.8% agreeing with the statement "I believe it is very important for practising nurses to have a good knowledge of bioscience subjects" (Friedal & Treagust, 2005:210). However, both could be interpreted as leading questions, which casts doubt over their value. Prowse and Health (2005) also used qualitative data from 32 interviews with staff nurses to gauge the impact of their bioscience knowledge on nursing decisions. However, it is difficult to gauge the strength of feeling in their discussions.

Contemporary studies have also used quantitative data to reinforce the claim that students value bioscience with comparable results (Clifton & McKillup, 2016; Fell et al., 2016; Gordon et al., 2017; Barton et al., 2021; Montayre et al., 2021). Clifton & McKillup (2016), however, hypothesised value by asking students to rank their course modules in order of satisfaction. In their study the three bioscience modules featured in the top 4, although a non-bioscience module on nursing practice occupied the number 1 spot. Fell et al., (2016) provided a more compelling picture of student attitude towards the bioscience. In response to the question "In your view, how important is a knowledge of bioscience to your professional role?" 98% of adult-field nursing students selected "important", "very important", or "essential" (the two other options being "slightly important" or "unimportant"). This view was reflected in children's nursing (100%) and mental health (90%). Gordon et al. (2017) provided

further confirmation. They found that 76.2% of their respondents selected “agree” or “strongly agree” to the statement “An understanding of bioscience forms the foundation of nursing practice” (Gordon et al., 2017:25). While this question does not explicitly mention value or importance, feeling that bioscience forms the foundation of bioscience suggests for those who responded positively bioscience is valuable as the absence of it suggests sub-optimal nursing practice. This arguably corresponds with the findings of Andrew et al. (2015) who suggest that the students in their qualitative study describe a co-dependency between self-efficacy in bioscience and confidence in their ability to care. Barton et al. (2021) also provided robust evidence that indirectly highlights that students value the biosciences. Several of their survey questions implied that bioscience is a vital component of nursing practice, and the sizable positive responses suggests that their students agree. For example, 90% of their 406 respondents, agreed with the statement that “Every nurse must have a good understanding of the biosciences” and 75% agreed with the statement that “Biosciences are an essential part of patient-centred nursing practice” (Barton et al., 2021:5). As with Gordon et al. (2017) the responses to these questions indicate that students place a high value on bioscience and the importance of bioscience in their education.

There are fewer examples of qualitative research exploring the value students place on the biosciences. Mowforth et al. (2005) explored students’ attitude towards the behavioural sciences, targeting biology, psychology, and sociology. While their analysis indicates students do value biology, there was no comparison to the other sciences and therefore this evidence is limited. Contemporary evidence, however, is more compelling with recent studies providing rigorous analysis that clearly highlights the high value students place on the biosciences and their reasons why

(Fell et al., 2016; Montayre et al., 2021). Fell et al. (2016) used focus groups to explore the value of bioscience in nursing practice. Their findings highlight three inter-related reasons to explain why student nurses consider the bioscience to be valuable: competence, confidence, and knowledge for patient care. Without bioscience knowledge, Fell et al. (2016) argue, students will feel incompetent and unable to function at a basic level. Neither will they be able to make the right choices regarding patient care or challenge other healthcare workers when advocating for their patients. The findings of Montayre et al. (2021) validate this view as they found students expressed the need for confidence to discuss and defend nursing decisions with other healthcare professionals, with bioscience being the source of that confidence. Furthermore, Montayre et al. (2021) assert that students see bioscience as the key to provided holistic care, especially when discussing care options with patients and their families.

Overall, the broad agreement that student nurses place a high value on the biosciences is validated by the literature. However, much of the evidence is historical and, in most instances, one-dimensional in that researchers have relied mainly on quantitative methodology. Such research is credible but fails to explain why students place value on learning bioscience. In the main researchers have explored the teaching and learning of the biosciences and questions on value are among multiple questions on a variety of classroom and predominantly practice based issues. Another key criticism is that all but three of these studies were conducted outside of the UK. Only Jordan et al. (1999), Clancy et al. (2000), and Fell et al. (2016) explored the views of students working in the NHS and under curriculum validated by the NMC.

2.10 Theme 8: Unprepared practitioners – students graduate with inadequate bioscience knowledge.

The notion that nurses qualify with inadequate levels of bioscientific knowledge is a long-standing one (Wilson, 1975). This assumption has been explored several times since, particularly since the advent of Project 2000 in the late 1980s. Recent research suggests that this is still the case (Gordon et al., 2017) and that contemporary thought indicates that this is an increasing cause for concern for the nursing profession given the role of the nurse continues to evolve and expand, particularly regarding non-medical prescribing and the Advanced Care Practitioner (ACP) role (Perkins, 2019). As Lord Willis stated in his review of nurse education and training, nurses will need to acquire more advanced knowledge to prescribe, diagnose, and make complex clinical decisions (Willis, 2015). For many researchers, this only serves to reinforce the importance of the biosciences as the basis of the knowledge Lord Willis referred to (Taylor et al., 2015; Wood et al., 2020). However, nurses with extended roles, such as prescribing report a lack of confidence in their abilities (King, 2004; McIntosh et al., 2016), a phenomenon that Khan & Hood (2018) claim stems from a lack of pharmacology in curricula. This criticism has merit because, as Latimer et al. (2017) acknowledges, in UK based nursing curricula, pharmacology is restricted to safe administration of medicines and drug calculation. The concerns that nurses are qualifying without the aptitude to adopt extended roles such as prescriber and advanced care practitioner (ACP) centre on two interlinked perceived deficiencies, namely confidence and knowledge. This perspective has a long history, and researchers have explored both perspectives in their attempts to confirm that students are qualifying with insufficient understanding of bioscience, prior to and after the introduction of nurse prescribing.

Rather than attempt to measure the bioscience knowledge levels of students and staff nurses, researchers have sought to investigate confidence and unpreparedness. In other words, nurses' expressions of low confidence or feeling ill-equipped or unprepared are symptoms of a bioscience deficient curriculum. Davis (2010), for example, indicated that the nurses in their study felt their pre-registration exposure to the biosciences did not ready them for qualified autonomous practice, with 40.5% of their sample of qualified nurses stating that their pre-registration course did not prepare them for their role as a qualified staff nurse. Similarly, McVicar et al. (2010) found that nurses reported a lack of confidence in their bioscientific knowledge and that they felt what knowledge they had, had been gained after qualification, and was only enough to "get by." According to McVicar et al. (2010), this self-reported perspective is reinforced by the enthusiastic adoption of early warning scores by contemporary nurses. The argument being that the conventional practice of determining the presence of acute deterioration using bioscientific knowledge and nursing acumen is more convoluted and demanding than using a scoring system that involves the calculation of a numerical grade based on physiological recordings and the following of instructions based on the results (Royal College of Physicians, 2017). While there is evidence that such warning scores enhance patient safety (Smith et al., 2013), McVicar et al. (2010) argue that their use does not encourage bioscience inquiry, resulting in the erosion of bioscience knowledge.

Clancy et al. (2000) also assessed confidence in bioscience knowledge. Questionnaire data from 153 students suggested that students do not feel confident in explaining biological principles or the pharmacological actions of the medicines they administer, especially when talking to doctors. Unsurprisingly, a greater number

of staff nurses expressed higher levels of confidence in their knowledge. However, using a rating scale of 1 – 10, with 10 being “very confident”, the mean score for staff nurses was 6, which Clancy et al. (2000) considered too low for qualified nurses, suggesting that nurses are qualifying with inadequate levels of bioscience knowledge. One criticism is that there is no accepted or standardised level of confidence to which they can make a comparison. However, a second questionnaire, completed by 174 staff, explored their confidence about the pathophysiology of influenza and found that 86.7% of respondents felt they needed to enhance their understanding of the virus and its associated bioscientific theory. Clancy et al. (2000) argue that this indicates that nurses qualify with deficiencies in their understanding of bioscience.

Subsequent studies reinforce these findings and indicate that nurses qualify with deficiencies in their understanding of the biosciences. Questionnaire data in a mixed methods study by Craft et al. (2016) highlighted that 50% of their respondents did not feel confident in their ability to discuss the biological basis of nursing. While this study had a small sample (n=22), almost all of them (95%) stated that they wished they knew more and had a more extensive understanding of bioscience. Gordon et al. (2017) also used questionnaire data to establish how 126 of their final year students felt about their knowledge and the importance of bioscience in nursing. While a majority (76.2%) acknowledge that bioscience was fundamental to nursing care, 73.8% felt they did not know enough about bioscience and would like to enhance their knowledge and understanding. More recently, qualitative analysis of 47 first year students also found that students lack confidence in their bioscientific knowledge. Redmond et al. (2022) used student assessments to assess their ability to use bioscience to negotiate a series of patient scenarios. While this study

primarily explored clinical reasoning skills the students also expressed a lack of confidence in their ability to apply bioscience.

The work of McVicar et al. (2010), Clancy et al. (2010), Craft et al. (2016), and Gordon et al. (2017) continues to be cited as evidence that nurses qualify with insufficient understanding of bioscience (Barton et al., 2021). However, given the nature of the evidence, a more appropriate claim is that nurses qualify as lacking in confidence regarding bioscience. This is understandable, in that all professionals qualify with feelings of inadequacy, and could simply be reflective of a period of adjustment, in which qualifying and newly qualified are apprehensive about the challenges of autonomous practice (Halpin et al., 2017). Certainly, anxiety and apprehensiveness were evident in newly qualified Project 2000 students (Robinson, 1991), and the move to all-graduate status has impacted how newly qualified nurses compare themselves with their experienced colleagues. Aubeeluck et al. (2016) for example, argued that nurses educated to a degree level tend to over-emphasise their practical skills over knowledge to gain status among nurses with lower levels of educational achievement.

There have been several attempts to quantify what qualified nurses know and understand in terms of bioscience. Wilkes & Batts (1998) used field notes and focused interviews to explore staff nurses' understanding of fundamental cardiovascular physiology, such as blood pressure and intravenous therapies. Their findings highlighted a lack of application of bioscientific knowledge in the nurses they interviewed and that there were commonalities in the way students and staff nurses used and disseminated biological findings. One such commonality was the value of shared experience over scientific fact. For example, knowledge passed on from nurse to nurse held more currency than actual physiological theory, resulting in

misinformed ideas concerning the interpretation of physiological readings accepted as truth. Another commonality was that nurses had a “task-orientated” or “doing” approach to their work, in which they saw their role as collectors of information rather than independent decision makers and therefore, reinforcing the stereotype of nursing as a sub-ordinate profession.

The work of Campbell & Leathard (2000) provided a much starker viewpoint and is viewed as a significant piece of evidence for the lack of an adequate knowledge base in qualified nurses. Their simplistic study evaluated the bioscientific understanding of 141 students and qualified nurses via a short exam. Their analysis suggested that the level of bioscientific knowledge in their sample varied widely, and the overall mean grade was only 13.95 out of 36, which they claim would not achieve a pass grade at secondary school (Campbell & Leathard, 2000). Aari et al. (2004) also evaluated their students and assessed their knowledge of physiology and assessed whether it was sufficient for intensive care. Their analysis of grades for 141 students found a lack of adequate understanding of the pulmonary, cardiovascular, and gastrointestinal systems, which is concerning. However, there is no tangible statement on what constitutes an adequate level of bioscience knowledge for intensive care. Their conclusions are simply that their students following their programme in Finland demonstrate lower levels of knowledge in comparison to other countries, namely the United States of America. King (2004) used qualitative data to explore the preparedness of qualifying nurses in terms of pharmacology. They argued that their interview analysis indicated nurses qualified with an inadequate level of pharmacology to the extent that they were anxious and lacked confidence when administrating drugs. While not providing quantifiable measure of their knowledge, this study, conducted in the UK, provided a clear insight

into the qualifying nurse's experience. In subsequent years, while arguably outdated, these pieces of research have been continually cited as evidence of poor levels of bioscientific knowledge in the nursing workforce, both in the UK and Australia (McVicar et al., 2010; McVicar et al., 2014; Birks et al., 2015; McVicar et al., 2015; Craft et al., 2016; Ralph et al., 2017).

Arguably, given that nursing is now an all-graduate profession, this evidence is outdated as entry requirements for degree programmes are higher and the validity of Campbell and Leathard's measure and its comparison to the GCSE level is debatable. No evidence of an accurate comparison between their questions and GCSE biology is provided, and therefore, it is difficult to discern the basis of their measure, rendering their assertion questionable. Furthermore, one could argue that the GCSE biology curriculum is not an adequate comparison. As Akinsanya (1987a) highlighted, nursing needs to appreciate the bioscience that applies to caring for another human being and not biology per se. In Campbell and Leathard's defence, establishing what nurses need to know is difficult to quantify. As Jordan & Reid (1997) contend, in terms of bioscience, there is no recognised measure of what nurses need to know.

There is, however, clear guidance on the topics nurses should appreciate, even if there is no recognised level of knowledge. The NMC, for example, provided clear guidance on which bioscientific concepts nursing curricula should include (NMC, 2010; 2018b). Furthermore, clear guidance on the bioscience concepts that are considered essential to preserve patient safety is available to nurse leaders (Taylor et al., 2016).

2.11 Theme 9: Inadequate clinical teaching - bioscience education in placement is inefficient.

Nurse education is a bipartite arrangement, with students spending 50% of their time in the classroom and the other half in clinical placement, learning alongside qualified nurses (NMC, 2023a). Attending placement and working in healthcare services, therefore, provides further opportunities for students to learn biosciences first-hand. Indeed, experienced nurses have a duty to teach and coach learners and play an integral part in the assessment of competence and suitability for autonomous clinical practice (NMC, 2018a; 2018b). A key piece of evidence for the notion that practising nurses do not possess enough bioscience knowledge to provide adequate clinical teaching is the mixed methods study by Fell et al. (2016). Fell et al. (2016) surveyed 112 students from all four fields of nursing and conducted focus groups, which included 17 students, to gauge the support they received from clinical mentors regarding bioscience learning. Staff nurse deficiencies in bioscience knowledge were clearly highlighted in their findings. Overall students felt their mentors demonstrated a good understanding of bioscience, however, a sizeable proportion (around 21%) felt qualified staff had insufficient knowledge, although sufficient knowledge is not quantified. The most compelling evidence came from the focus group discussions, in which students described some qualified nurse's bioscience knowledge as "lacking" or "variable," and more significantly that their deficiencies in knowledge were "quite scary," and even "terrifying." (Fell et al., 2016:2701).

One criticism of these findings is that they are based on the discussion of a small numbers of students (n=17). However, a study into the bioscience knowledge levels of qualified nurses, indicates that for many their appreciation of the

biosciences is either inadequate or that bioscience is almost irrelevant (McVicar et al., 2010), which arguably validates these students' claims. McVicar et al. (2010) primarily explored the use of early warning scores, but their findings suggest nurses held varying views on the importance of the biosciences in nursing decisions as well as varying degrees of underpinning bioscientific knowledge. This arguably suggests that some staff nurses struggle to articulate what they know in terms of bioscience and could explain the student nurse's adverse reactions to the lack of knowledge found by Fell et al. (2016).

In addition to a lack of knowledge and understanding amongst staff, Fell et al. (2016) also identified a culture of negativity towards the biosciences, which they argue is detrimental to learning. The respondents in their study suggested that some clinical areas had a positive attitude towards bioscience, critical care areas such as intensive care, theatres, and accident and emergency, for example. In areas with a positive attitude towards bioscience, nursing staff were happy to impart their knowledge and teach students the relevance of physiological measurements. However, several clinical areas were described by students as having a negative cultural perspective toward bioscience. In some clinical areas, students find that bioscience is marginalised in favour of the development of skills or to complete rudimentary tasks. Indeed, students feel that in such areas, bioscience is not a priority, is not emphasised or discussed, and is viewed as an inconvenience. Practice assessors and supervisors in more bioscience-sensitive areas were more likely to stretch, challenge and evaluate their student's understanding, something the students valued. Whereas in areas with a negative bioscience culture, students felt their bioscience-related questions were ignored or disregarded. Practice assessors and supervisors in these areas tended to discourage or avoid bioscience enquiry by

asking students to research their bioscience question themselves and report back to the mentor with the answer (Fell et al., 2016).

These perspectives are reflected in the work of Molesworth and Lewitt (2015). As with the students in the study by Fell et al. (2016), these students also highlighted that the quality of teaching and learning of the biosciences was practice area dependent. Molesworth and Lewitt (2015) also highlight a balance between commitment and teaching ability. The students in their study recognise that their practice colleagues are not qualified teachers, and this can cause issues with learning. However, a commitment to the biosciences can compensate for a lack of teaching prowess, the argument being that a willingness to teach and discuss the importance of the biosciences outweighs the individual's personality or teaching ability. As Fell et al. (2016) argue, a lack of enthusiasm for the biosciences erodes the trust students have in qualified nurses and bioscience education suffers as a result.

Another key finding by Molesworth and Lewitt (2015) was the impact of time as a resource. Students are expected to learn while working on frontline services. However, students find learning bioscience in placement is considered subordinate to the other competing practice demands, leaving no time for learning bioscience. This is a common complaint among students and staff alike, hence the need for protected learning time for students (NMC, 2018b). While this argument is true of all aspects of nursing knowledge, including the social sciences, it remains noteworthy that bioscience teaching is often considered of secondary importance due to a negative bioscience culture or a lack of knowledge in staff nurses, in the eyes of students from two separate studies.

2.12 Theme 10: An anti-bioscience culture – there is a historic cultural rejection of the biosciences.

Another contributory factor to inadequate teaching of the biosciences in practice-based nurse education is the perceived notion that for many nurses, the biosciences are undervalued and culturally incompatible. Rather than viewed as being integral to nursing care the biosciences are considered an inconvenient adjunct. The literature suggests a schism within nursing practice between those that believe that possession of bioscientific knowledge is essential and those for whom bioscience remains an alien concept that is incongruous to nursing practice (Jordan, 1994; Jordan et al., 1999; Logan & Angel, 2011). Nurses are caring individuals, who rely on intuition and nursing acumen, and not what Logan & Angel (2011) refer to as "bedside scientists". Traditionally, nurses were taught bioscience by doctors (Akinsanya, 1987a) which created a historic view that bioscience was an educational appendage rather than a principal aspect of nursing knowledge. In 1998, Wilkes and Batts argued that nursing was still viewed, both publicly and professionally as a sub-ordinate role, in which nurses conduct tasks allocated by doctors (Wilkes & Batts, 1998). The basis for this perspective was nurses rejecting scientific objective knowledge, which was viewed as too technical and systematic, in favour of physiological explanations more akin to notions of care and compassion. Nurses were in effect, using their own accepted physiological language, which was not based on biological fact but on misconceptions handed down through generations of nurses (Wilkes & Batts, 1998).

Nursing is both an art and a science (Masterson & Robb, 2016). However, for many nurses, it is the art that has priority, art being notions of care, compassion, concern, and promotion of dignity and comfort. Nurses tend to view science as an

appendage to practice rather than an integral component of nursing knowledge and the more science integrates into nursing theory the further nursing moves away from its core principles. This may explain why, traditionally, nursing academics tended to favour research into psychosocial aspects of care, ensuring there is little research into biological influences (Jordan, 1994). Logan & Angel (2011) refer to this perceived gap between the objectivity of science and the intuitive art of nursing as science-nurse tension. Logan & Angel (2011) argue that the cultural rejection of the biosciences reflects nursing's dual philosophy. Nursing science, for example, has a care and a scientific philosophy. Care concerns the attention to matters of the body, soul, and mind of people, and is associated with comfort and living well (Cox, 2004). Science, however, as taught to nursing students, follows a "medical model" associated with diagnosis and cure, which are not considered to be "nursing" and devalue the emotional aspects of care and compassion (Wynne et al., 1997). While nurses value and accept bioscientific knowledge enhances their care, a tension remains, which manifests as a struggle to identify as scientists or reconcile that science is integral to nursing care. Jordan et al. (1999) reinforces this view and found that nurses considered themselves to be "ministering angels" rather than "technicians." Contemporary evidence, however, suggests that modern student nurses are more scientific in their approach and place a high value on bioscience, which suggests that this perspective may now be outdated (Fell et al., 2016; Montayre et al., 2019; Barton et al., 2021; Montayre et al., 2021).

2.13 Conclusions drawn: A need for further investigation.

The analysis of literature published between 1991 and 2023 suggests that within nurse education there is a consensus that a "bioscience problem" exists,

which has a negative impact on quality of patient care and the quality of practice-based teaching. The literature suggests that the “bioscience problem” leads to some nurses qualifying with an inadequate understanding of bioscience, despite there being no consensus on what constitutes a requisite level of knowledge. The most compelling contemporary evidence for this assertion is based on low confidence levels in qualified nurses (Craft et al., 2016; Gordon et al., 2017) and reports of poor teaching in clinical practice (McVicar et al., 2010; Fell et al., 2016).

There is also evidence that many of the phenomena noted in my own teaching experiences are validated by the research and viewed as part of the “bioscience problem.” The feelings of anxiety expressed by my students when faced with learning of the biosciences is also reflected in the literature (Nicoll & Butler, 1996; Jordan et al., 1999; Clancy et al., 2000; McKee, 2002; Gresty & Cotton, 2003; Andrew et al., 2008; Craft et al., 2013; Mortimer-Jones et al., 2018). This anxiety is exacerbated by the perceived challenge of learning what students feel are complicated concepts (Caon & Treagust, 1993, Chapple et al., 1993, Craft et al., 2016; Gordon et al., 2017) and a lack of classroom time (Nicol & Butler, 1996; Jordan et al., 1999; Friedal & Treagust, 2005; Davis, 2010).

While the “bioscience problem” is reflected in my own teaching experiences the evidence for its existence arguably lacks authority for two broad reasons. Firstly, some of the evidence is historic and secondly the disparate locations of the main research calls into question its applicability to the UK. In terms of age, all but two of the eight published research projects that concluded students suffer anxiety in relation to bioscience were published before 2009 and, therefore, arguably out-dated, especially since they were all published before the UK’s conversation to an all-graduate route into nursing. Likewise, the evidence for the notion that students

find the biosciences too difficult is equally dated with six of the eight published research studies also being executed before 2009. This arguably weakens the argument for perceived difficulty despite evidence by Jordan et al. (1999) and Gresty & Cotton (2003) being cited in recent research (Gordon et al., 2017). Evidence for the desire for more classroom time, however, is more compelling and contemporary (Owens 2020; Mhlongo & Masango, 2020). However, neither of these studies was conducted in the UK.

A lack of evidence from the UK is another concern. While just over 50% of the research identified was conducted in the UK (25 out of 49), all but four of those projects were published before 2015, with 19 published before 2006. Most of the research performed after 2015 was conducted overseas, namely Australia (Gordon et al., 2017; Ralph et al., 2017; Mortimer-Jones et al., 2018; Owens, 2020; Barton et al., 2021), New Zealand (Montayre et al., 2019; 2021), and South Africa (Mhlongo & Masango, 2020). Therefore, there is, a lack of contemporary UK based research into the learning of bioscience in nurse education. This questions whether bioscience remains problematic for contemporary students studying and working in the UK.

Analysis of the identified research projects also highlights a lack of qualitative research exploring the experience of learning the biosciences in the context of a contemporary student nurse working in the UK. Almost half of the research projects (24) rely solely on data gathered from questionnaires or surveys and while not exclusively quantitative the qualitative data gathered is arguably one dimensional and lacking depth. A further 5 studies use tests or examine assessment grades to inform their analysis (Campbell & Leathard, 2000; Ofori, 2000; McKee, 2002; Aari, 2004; Whyte et al., 2011). The remaining 20 studies all use qualitative data but there

is little in-depth analysis of the student's perspective of learning. Three studies use diaries to collect experiences but all three explore the thoughts and feelings of qualified nurses (Jordan & Reid, 1997; Jordan, 1998; Jordan & Hughes, 1998). Of the remaining 17 studies, the 8 that used interviews are in the main studies exploring the qualified nurse perspective (Wilkes & Batts, 1998; Prowse & Lyne, 2000; King, 2004; Prowse & Health, 2005; McVicar et al., 2010; Montayre et al., 2021) with just two exploring the student view, one of which is out-dated (Chapple et al., 1993) and the other conducted in Australia (Andrew et al., 2008). Of the 9 that used focus groups, 8 explored the student perspective, of which 6 are arguably out of date (Nicoll & Butler, 1996; Thornton, 1997; Jordan et al., 2000; Manias & Bullock, 2002; Friedal & Treagust, 2005; Mowforth et al., 2005) and of the remaining 2 studies Barton et al. (2021) was conducted in Australia and Molesworth & Lewitt (2015) while conducted in the UK included just 7 students.

2.14 The research questions.

The conclusions drawn in 2.13 raise two key questions. Firstly, given the claims within the literature are historic and not exclusive to the UK are they still applicable to the contemporary nursing students I teach. Secondly, given the lack of a qualitative insight in recent research, what are the perspectives and experiences of modern UK nursing students in relation to their learning of the biosciences? The focus of this thesis therefore is to answer the following questions:

1) To what extent do the biosciences remain a cause for concern among contemporary adult-field students completing a BSc (Hons) Nursing programme?

2) What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?

It is important to confidently identify the causes for concern. This review of the literature has done this. In seeking to answer question 1, I can establish the extent to which these causes for concern remain a reality for contemporary students. Historically, the most common causes for concern from the student perspective are anxiety, perceived difficulty, and perceived lack of classroom time, and therefore all three will be used to examine the perceived problematic nature of the biosciences. There is a need to establish the extent to which students' feelings of anxiety, beliefs of complexity and desire for more classroom time are exclusive to bioscience.

As revealed in 2.9, students value the biosciences, arguably more than other aspects of the curriculum, in particular the social sciences, and consider it essential for effective nursing care. This, therefore, prompts a sub-question "do contemporary adult-field nursing students still value the bioscience aspects of their course?" As with the causes for concern, any positive views towards the biosciences would only be demonstrable if there is a comparison to the value students place on the other aspects of their learning. Therefore, in seeking to answer question 1, this thesis will also seek to answer the following sub-questions:

A) Is bioscience more likely to cause anxiety in adult-field nursing students than social sciences and nursing theory?

B) Is bioscience perceived to be more complex and challenging than social science and nursing theory by adult-field nursing students?

C) Do adult-field nursing students feel a need for an increase in bioscience classroom time?

D) Is bioscience still a valued part of nurse education for adult-field student nurses and how does this view compare with social science and nursing theory?

E) Do adult-field student nurses still regard bioscience knowledge as a determinant of effective nursing care and how does this view compare with social science and nursing theory?

2.15 Chapter summary.

This chapter examined literature published between 1991 and 2023 and identified ten themes that characterised the so-called “bioscience problem”. The ten themes also describe the journey an individual makes from commencing nurse education with a lack of bioscience knowledge, through challenges learning bioscience in class and practice, which lead to nurses qualifying deficient in an appropriate level of bioscientific knowledge. However, the legitimacy of the arguments in the literature and their relevance to students studying at my own institution is questionable because it is dated and transcontinental. Furthermore, the literature is predominantly tutor orientated, with little qualitative data exploring the student perspective. Therefore, the research questions discussed on section 2.14 seek to establish the concerns and perspectives of a contemporary cohort of student nurses. The next chapter will discuss how a humanistic and student-centred approach to data collection leads to a data that truly reflects the authentic student perspective of their learning.

Chapter 3

The unencumbered student voice: A humanistic method for accessing the authentic student perspective

This chapter explores the decision to access the unencumbered student voice to collect data. It also defines and explores the influences and biases that informed this thesis in terms of data analysis and data collection. As Silverman (2013:50) argues “no data are untouched by the researcher’s hands” and therefore it is prudent to acknowledge the personal perspectives and beliefs through which the data was analysed. A major influence on this thesis is my clinical and teaching experiences, which this chapter will argue are constituent parts of a dual professional identity, which both impact on what I saw in the data. In addition to professional experience, this chapter also explores the ontological and epistemological perspectives that informed data collection and analysis. Daniel & Harland (2017) define ontology as a system of belief and interpretation of what comprises knowledge and understanding that is associated with personal convictions, opinions, and values. According to Mauthner & Doucet (2003), exploration of one’s ontological and epistemological assumptions is an integral part of reflexivity and for Maxwell (2017) close regard to both ontological and epistemological influences ensure a critical realism that provides authenticity. Maxwell (2017) further explains that while ontology is concerned with the notion that a real world exists independently of personal perspective, epistemology acknowledges that an individual’s understanding of the real world is of their own construction, and therefore understanding of reality without mediation by our personal viewpoint is not possible. As this chapter will discuss, this thesis is heavily influenced by humanism, humanistic psychology and humanistic

research principles, particularly the concept of unconditional positive regard, all of which informed the choice of the unencumbered student voice as an authentic method of fostering unconstrained conversations, free from fear of retribution, as an ethically sound data collection method that can access experiences that traditional qualitative methodologies neglect thus liberating the hitherto unheard student voice.

3.1 Bioscience and nursing.

My main area of interest is physiology and more specifically the pathophysiology of acute deterioration. My first teaching experiences occurred as a visiting lecturer and involved teaching qualified nurses about respiratory failure and the physiological underpinnings of ventilation as an acute intervention, and in the years that followed the teaching of bioscience has always formed part of my educational portfolio. While I feel able to teach a wide range of nursing subjects, it is bioscience that defines me as a tutor. As Harness & Boyd (2021) identified, tutors can be divided into tribes, with nurses in particular feeling atypical and separate from tutors of other disciplines. Arguably, within nursing there is a bioscience tribe that comprises of nurses enthusiastic about human biology, a tribe that I feel part of. This implies that there are tutors who do not share my passion for the biosciences, a notion that has a historical evidence base (Courtenay, 1991; Wharrad et al., 1994; Friedel & Treagust, 2005; Taylor et al., 2015).

I believe that understanding the underpinning principles of human physiology, especially that relating to the heart, lungs, brain, and kidneys, is fundamental to the detection of acute deterioration in people suffering from any given disease or illness. Furthermore, I would argue that the provision of effective care for vulnerable

individuals living with disease and illness requires knowledge of the underpinning biological factors that determine an individual's wellbeing. Therefore, bioscience should be an integral part of nurse education. My convictions are reflected in the literature. Indeed, the notion that bioscience is an essential ingredient in the nursing curriculum is widely accepted and, overall, a ubiquitous unquestioned international premise (Clifton & McKillup, 2016; Fawcett et al., 2016; Taylor et al., 2016; Perkins, 2019; Montayre et al., 2021). However, while the need for bioscience in nursing curricula seems self-evident and an ever-present premise in nurse education literature, my convictions are undermined by a lack of evidence to validate them.

A pivotal argument for the inclusion of bioscience in nurse education is one of holism. Central to nursing theory is the notion that care is primarily concerned with the whole person. An individual living with a long-term condition will experience pathophysiological changes. However, their experience of those changes and the way they cope with their condition are dependent on their psychological and social status as well as the political system they exist under. For example, income, size of dwelling, family and social support, lifestyle as well as political decisions on services all impact an individual's wellbeing. Every individual a nurse encounters should, therefore, be viewed from a unique perspective (Baille & Black, 2014). The argument that holistic care only occurs when nurses recognise bioscientific influences on their patients' wellbeing is a long-standing hypothesis. Wynne et al. (1997) argued that the attrition of bioscience from nursing curriculum was eroding holistic care, a concept they referred to as incomplete holism and Trnobranski (1993) proposed that nurse education should aim to produce intelligent practitioners capable of intelligent practice, which can only exist if nurses appreciate the influence of the biosciences. The belief that bioscience is integral to holistic care, and

therefore, analogous to nursing ethos was widely considered a major reason for its inclusion in nursing curricula. Any exclusion or reduction in the quality of bioscience would lead to incomplete holism and, therefore, inadequate nursing care (Christensen et al., 2015; Montayre et al., 2021).

While nursing theorists have attempted to justify the need for bioscience in terms of holism there remains little evidence of its efficacy in terms of enhanced patient care. This in part is due to the challenge of determining how to measure the efficacy of the influence of bioscience on patient outcomes and a lack of inclination to prove what is a widely accepted norm. Nevertheless, there have been attempts to establish beneficial links between enhanced bio-scientific knowledge and augmented patient care (Jordan & Reid, 1997; Jordan & Hughes, 1998; Prowse & Lyne, 2000, Prowse & Heath, 2005; Christensen et al., 2015; Montayre et al., 2021). In their action research studies, Jordan & Reid (1997) and Jordan & Hughes (1998) investigated staff nurses use of bioscience to make decisions. Whilst their triangulation of themes generated from diaries, questionnaires, and interviews provides some robust evidence, their results only highlight enhanced patient care about a small number of specific areas of nursing (hydration and nutrition, for example) and their assertions were arguably based on self-reported data rather than recordable clinical outcomes.

Likewise, Prowse & Lyne (2000) found that data generated from thirty-two interviews across 2 sites reinforced the notion that greater levels of bioscience knowledge enhanced airway management in the post anaesthesia setting. Their findings were later validated through the analysis of interviews with 32 anaesthetic nurses, which revealed that nurses relied heavily on their knowledge of bioscience when making care decisions and that their bioscientific knowledge enabled them to

work collaboratively with other health professionals and enhance patient outcomes further. This notion was reinforced five years later when further interviews produced similar findings (Prowse & Heath, 2005). However, as with previous studies (Jordan & Reid 1997; Jordan & Hughes, 1998), the data was self-reported, and findings based on nurse opinion as opposed to objective clinical data.

While most of the evidence for the necessity for bioscience education for nurses is dated, there is contemporary evidence that suggests strong links between bioscientific knowledge and enhanced patient care. Montayre et al. (2021) maintain that there is a connection between levels of bioscientific knowledge and the ability to provide compassionate care for both patients and families. They argue that bioscience allows nurses to make connections between what they observe and how they communicate their nursing decisions. Interviews with fifteen post-graduate nurses revealed that bioscience promoted their confidence and ability to speak with conviction. This enhanced their communication skills and fostered trustworthiness in their patients and their loved ones. However, as with historic evidence, these findings, while informative, do not provide objective proof of a clear clinical link between bioscience education and enhanced patient care.

Irrespective of theory and evidence the content of nursing curricula is determined by nursing's governing body, the NMC. Despite the paucity of objective evidence based on clinical outcomes reinforcing the need for bioscience within nurse education, the NMC clearly outline in their Standards for Pre-registration Nursing Education that basic science constitutes a significant element of nurse education alongside social science, nursing theory, and nursing practice. Furthermore, their Essential Skills Clusters, which relate to performance in clinical practice, clearly reinforce the need for an optimum understanding of bioscience on several

occasions. For instance, before registration nurses must be able to make holistic assessments that include physical needs, act autonomously in response to abnormal vital signs, recognise potential signs of infection, identify signs of dehydration, and assess the effects of medication including pharmacodynamics and pharmacokinetics (NMC, 2010; 2018b). Given all nurse education courses must satisfy the standards as laid out by the NMC there is no leverage, bioscience exists within the curriculum and it needs to be taught, digested, and assessed.

Furthermore, from a contemporary nurse education perspective, the need for bioscience in nursing is considered self-evident and its exclusion from curricula would not be entertained (Taylor et al., 2015; Taylor et al., 2016). It is for this reason that evidence in defence of including bioscience in the curriculum is all but absent. It is inconceivable that any Higher Educational Institution would want to risk the removal of bioscience to test a hypothesis that it adds little value to patient care. The presence of this argument also raises questions on how nursing as a profession is perceived by others. It seems unimaginable that anyone would question the need for doctors to study anatomy. Yet, I have found that non-nursing teaching colleagues have been prepared to question the need for similar subjects in nursing and enquire if evidence for the efficacy of bioscience education in nursing exists. This raises questions about the public view of nursing as a profession and suggests that for some the appreciation of the biological sciences by the individual's caring for them, even in perilous states, is not a priority. Such a view corresponds with evidence of a lack of appreciation of the reality of contemporary nursing, which is still viewed as a job "nice women" do (Trueland, 2020) who execute menial tasks and remain at the bottom of the NHS hierarchy (Morris, 2010). Such a notion only serves to bolster my desire to research the learning and teaching of the biosciences not only to explore

student learning but also to reinforce the need for nurses to be recognised as autonomous professionals, intellectually able to make clinical decisions and to work in partnership with other healthcare professionals.

3.1.1 Professional dualism.

My primary occupation is University Lecturer. However, I am also recognised as a nurse and healthcare worker, despite not being employed to care for individuals. I am a qualified teacher employed as a Senior Lecturer to teach nursing on pre- and post-registration courses, but I am also a qualified nurse, registered with the NMC, and remain subject to their code of professional conduct and liable to limitations on my practice or removal from the register should I be judged to have contravened it. Pennbrant (2016), argues that this split professional identity is common in nurse educators and that our nursing experience provides a unique perspective on teaching and educational activities. Arguably, this unique perspective has influenced the approach taken to the interpretation of data and the execution of this thesis.

While teaching and nursing complement one another, simultaneous education and nursing cognitive deliberations can be problematic for nurse educators. Andrew & Robb (2011) refer to this outlook as a duality of professional practice in nursing, in which nurse tutors struggle with what they perceive as blurred professional boundaries between their two specialisms. This dyadic is common among nurse educators and generates a professional credibility crisis that impacts teaching and research (Adams, 2011). The role of the nurse educator is complex. It comprises all aspects of teaching, including mastering teaching methods, using contemporary technologies, promoting learning, encouraging curiosity and critical thinking, as well

as pursuing scholarly activity and research. In addition, nurse educators must also ensure their knowledge and understanding of their initial profession is appropriate and adequate to enable them to practice. However, a lack of first-hand clinical practice can cause an identity crisis, in which nurse tutors feel inadequate or no longer clinically credible (Andrew, 2012). To compensate for this, nurse tutors remain keen to continue to maintain a clinical perspective and outlook in all their teaching and work with students. Bono-Neri (2017) encapsulates this perspective in their description of praxis as a pedagogical approach to nurse education. Nurse education must be viewed as a multi-dimensional activity in which nurse tutors must exchange and share knowledge that transcends traditional learning and encompasses clinical scholarship, reflection, and shared social purpose. Culturally, nurse education, while stationed in university settings and underpinned by pedagogical theory, is still wedded to nursing traditions, identities, and philosophies. As Harness & Boyd (2021) discovered, contemporary nurse educators still primarily identify as nurses, as opposed to tutors, even if they have not practiced recently. It is the nurse within them that informs their decisions, perspectives, and the emphasis they place on the topics they teach.

3.1.2 Nursing philosophy.

Being culturally wedded to nursing culture and philosophy presents a dichotomy. This thesis has been completed for the partial fulfilment of a doctorate in education. Therefore, its primary essence should be education. However, the influence of nursing on how I approach scholarly work is inescapable, due to my nursing heritage. It is important, therefore, to explore the nursing perspective and how it has influenced my approach to data analysis.

Nursing as a concept is not well defined or established. International convention dictates that nursing is both an art and a science (Masterson & Robb, 2016). This ethos is universally accepted and a cornerstone of nursing philosophy, which has, at its heart, a long commitment to humans and healthcare (Rogers & Freiberg, 1994). However, neither the art nor science of nursing are well defined. This is understandable given the vast array of functions and roles nurses adopt and perform. As Parker & Smith (2015) argue, nursing encompasses so many different tasks and functions and nurses fulfil a multitude of roles and positions, reducing the essence of nursing into a simple digestible definition is problematic. Traditionally, nursing is defined by what it is not or how it differs from medicine. This view stems from Florence Nightingale, who argued that nursing was idiosyncratic and separate from medicine, in that its focus is on the healing process rather than the disease (Nightingale, 1860/1969). While this outlook of placing the patient at the centre of care, modern nursing also concerns itself with cognitive well-being and the promotion of self-care. Therefore, Jenner's assertion that the art of nursing is "the intentional use of oneself, based on skills and expertise, to transmit emotion and meaning to another," best encapsulates the essence of nursing (Jenner, 1997:5).

Modern nursing in the UK is defined by its values. This is evidenced by the adoption of the values-based recruitment framework in 2016 (Health Education England, 2016). The aim was to establish a culture of shared common values, which place others at the centre of healthcare. The key values laid out by Health Education England were putting people first, protecting dignity, committing to quality care, compassion, commitment to improving lives, and recognising everyone counts. The driver for the adoption of values-based recruitment was the failings highlighted in the public inquiry into the care at Mid-Staffordshire NHS Foundation Trust

(Francis, 2013). However, despite the adoption of values-based recruitment, the values that encompass nursing and what is meant by value are ill-defined and open to interpretation (Schmidt & McArthur, 2017). Groothuizen et al. (2017) argue that the root of values is ethical and that they originate from virtues and can focus on actions and consequences. McIntyre (1997) offers a compelling definition of virtues in that they are acquired qualities that enable people to achieve something good when the lack of virtue prevents us from doing so.

If nursing is best expressed through its values, then they are best summarised by the NMC's Code of Professional Conduct (NMC, 2018a). The code divides professionalism into 4 discrete areas, each of which contains a set of standards. I believe that the first discrete area, "Prioritise People" best describes the essence of nursing philosophy (see below). As sections 3.2, 3.3, and 3.4 will argue these values are analogous to the principles of humanism, humanistic psychology, and humanistic research, in that they seek to treat participants with respect and freedom to express themselves.

1. Treat people as individuals and respect their dignity.
2. Listen to people as individuals and respect their dignity.
3. Make sure people's physical, social, and psychological needs are assessed and responded to.
4. Act in the patient's best interests at all times.
5. Respect people's right to privacy and confidentiality (NMC, 2018a).

3.2 Humanistic Research.

Considering the above, a decision to adopt a humanistic approach to the research logically follows. Humanistic research methodologies encompass a range of approaches, but all share the belief that human experience is of value. Humanistic research methodology is considered a branch of the interpretivist or naturalistic research paradigms, which are a retort and reaction to positivist or scientific research paradigms, which believe that there is a reality that can be established through objective scientific study. In contrast, the interpretivist view is that reality is not a fixed entity, multiple realities exist each one existing within a given context that is discretely interpreted by an individual. Naturally, human experience is open to interpretation and therefore could lead to two people reporting differing explanations of the same event. However, from a humanistic research perspective, this is not problematic. Indeed, such differences are in themselves interesting, and we should seek to understand them. Humanistic research processes are aligned to the principles of humanism in that meaning is ascribed to the lived experiences of individuals. As will be argued in Chapter 4 phenomenology is my choice of humanistic research approach for this thesis as it is concerned with human experiences rather than ideas and concepts ascribed to the world we live in (Newby, 2014).

3.3 Humanistic psychology.

My teaching practice is heavily influenced by humanistic psychology. Humanistic psychology is concerned with the whole person and believes human behaviour should be analysed not only through the eyes of the observer but also

through the eyes of the individual displaying the behaviours. The main exponents of humanistic psychological pedagogy are Abraham Maslow and Carl Rogers. The key concept of Maslow's hierarchy of needs is a journey towards "self-actualisation" and that the main objective of learning is the discovery of identity rather than the mere instilling of facts (Maslow, 1971). I have an affinity for this view as the core values of education are to foster curiosity, enthusiasm, initiative, and responsibility rather than treating students as repositories for information. Likewise, I find the notion of facilitation, as opposed to instruction, appealing. Teaching, Carl Rogers argued, is an over-rated activity, and that facilitation of learning is what we should strive for, especially with increased student involvement, self-initiation, and self-evaluation to promote meaningfulness. Facilitation, according to Rogers, is reliant upon three interrelated concepts, namely congruence, empathy, and unconditional positive regard (Rogers, 2020/1967). All three concepts are based on humanity and respect for others. Congruence for example is essentially being true to oneself and not being afraid to be human in front others to establish rapport (by being open about one's feelings for example). The interlinked concepts of empathy and unconditional positive regard have relevance to this thesis. By being empathic Rogers encourages us to be sensitive to an individual's internal frame of reference, which will involve taking heed of an individual's personal circumstances or perspectives in addition to course content. By allowing individuals to speak freely and to be able to speak about whatever they feel is relevant to them, this thesis is arguably demonstrating empathetic understanding as defined by Rogers (Rogers, 2020/1967; Purswell, 2019). Unconditional positive regard is the acceptance of another's view regardless of whether one agrees with them (Rogers & Freiberg, 1994). This is separate from acceptance, in which we accept another has a right to their opinion, it is valuing and

caring about another's point of view (Purswell, 2019). Unconditional positive regard facilitates a reduction on pre-conceived ideas and bias at the data analysis stage by recognising that whatever the participants say has value.

Humanistic educational approaches have their critics. There is a lack of empirical evidence of effectiveness and humanistic educational theory relies too heavily on assumptions concerning human behaviour. Furthermore, self-actualisation could lead to self-centred learners who respond poorly to criticism or guidance. The attainment of facts in certain circumstances is a sound educational aim and that enjoyment and fulfilment could be achieved by the acquisition of information. In nurse education, there is often anxiety to ensure that essential information is delivered in a didactic and almost rote method to reassure the public that students have learnt and digested fundamental care principles, the step-by-step basic life support algorithm for example (Hughes & Quinn, 2013). Nevertheless, as an underpinning educational philosophy, I feel comfortable approaching my teaching from a humanistic pedagogical perspective, and although humanistic psychology and humanism are not related there any many commonalities in that they both seek to treat human beings with mutual respect and are based on an ethical code that promotes autonomy and a framework in which humans can flourish.

3.4 Humanism.

The attraction of humanistic psychology and humanistic research is perhaps explained by my own belief system and how seek to understand the world. In terms of personal philosophy, I would describe myself as a Humanist and this viewpoint influences approaches to my life, relationships, and my work. Humanism is a

philosophical position that promotes the value of human life and the autonomy of human beings. One of the central tenets of the philosophy is that gods do not exist and consequently, there is no afterlife or reincarnation. The life that one leads is the only life one will experience and therefore rather than there being one overarching religious “meaning of life,” there are multiple “meanings of life,” which are individually determined. Furthermore, the supposition that religion provides a moral compass is deemed illogical. People are intrinsically good, and humans can lead a meaningful and altruistic existence in the absence of religious instruction. Humanism is often seen as an objective viewpoint that is embedded in scientific rationality and therefore the development of human communities should only be based on decisions established through reason, scepticism, and science (Cave, 2022).

Contemporary humanism is often defined by its atheism. However, the essence of humanism lies not in its rejection of religion but in its commitment to the existence and importance of moral values. Ethics should be based on empathy and concern for fellow human beings to help them to flourish. A humanistic outlook is one of complete impartiality with blindness to sex, sexuality, skin colour, ability, and class. The hallmarks of the humanist perspective include freedom, tolerance, justice, and happiness (Law, 2011). Arguably, the fundamentals of nursing practice are closely aligned to the humanism view of life in that nurses demonstrate a commitment to beneficence, the protection of dignity and individuality, and the promotion of autonomy, all while remaining areligious in their outlook. As Traynor (2009) highlights the link between humanism and nursing practice has been a ubiquitous topic for nursing academics since the 1970s and are well established inter-related concepts.

3.5 Further pedagogical influences.

In addition to humanistic psychology other pedagogical theories have also shaped the approach to this thesis. Nietzsche's view that perspective comes from a language of vision on which people see things from and with a personal perspective, for example, informs my work. If truth is personal and dependent on how an individual views the world, it follows that researchers need to gain access to their participants' individual truths if they are to accurately gauge experiences and perspectives. In essence, what is important and of significance is what the individual believes to be true, irrespective of whether that belief has validity or is factually correct. It is their truth, which has been informed and influenced by their experience. In the context of this research, allowing the students to express themselves through conversation and free of interference or influence of the tutor, would encourage students to express their perspective of learning biosciences, which is representative of their truth (Tanner, 2000; Cate, 2003).

Another influential pedagogical perspective is Freire's theory of critical consciousness. Freire (1996/1972) argued that suppressing the student voice or denying learners opportunities to speak out is oppressive and de-humanising. While this principle informs the qualitative phase of this thesis it also raises the potential for the neglect of important data. As Seale (2009) argues, giving voice to the least powerful is especially important as it provides access to often ignored perspectives. In executing this research attention was paid to Freire's principle of "dialogue liberates – monologue oppresses." in which techniques or interventions that enable tutors to get to know their students with a degree of intimacy are promoted. The theory being that students respond more willingly (and indeed thrive educationally) if they feel teachers are interested in them as individuals, beyond how they are

progressing academically (Freire, 1996/1972). Freire provided further influence in terms of the recognition of relationship between the tutor (and researcher) and the student. Again, as Seale (2009) highlights, humility is required on behalf of the tutor, so they do not see themselves as a "case apart" from students (Seale, 2009:999).

Knowles argued that adult learners (as opposed to children) sought to govern their learning and that educationalists must recognise that adults have a view of themselves as learners and can determine their own learning needs. Furthermore, adult learners can draw on a wealth of first-hand experiences that provide a rich resource that can inform their learning. Adults (as opposed to children) are more concerned with learning to solve problems rather than engaging in education for the sake of learning something new (Knowles et al., 2014). Knowles theory of andragogy, while popular is much maligned and subject to extensive criticism. The main criticisms centre around the paucity of empirical evidence supporting its efficacy and its lack of generalisability (Conway, 2023). Critics highlight that theories of andragogy were based on the experience of white male adults and fail to take account of diverse cultures and backgrounds (Roessger et al., 2022), which suggests it is unsuitable for the highly diverse student population in this study. Nevertheless, key tenets of the philosophy of andragogy do have relevance to this investigation. The assumption that all learners have a need to be valued and respected is analogous to unconditional positive regard and ensuring students are free to express themselves and that their views and perspectives are considered significant and valuable (Raymond & Dahlke, 2021).

3.6 The student voice.

Ultimately, the tenets of humanistic research and humanistic pedagogy are concerned with the rights of learners and, more specifically, their right to be heard**.** A concept best encapsulated by Seale (2009:998) as “the student voice,” which is the following four linked meta-cognitive activities:

- Asking questions about student experiences
- Seeing and understanding the student perspective
- Reflecting on implications for practice
- Hearing or listening to previously inaudible or ignored voices.

A key underlying principle of paying heed to the student voice is that listening to students empowers them and leads to positive outcomes in terms of student experience and their learning (Cook-Sather, 2006). Aligned to this perspective are ideas of emancipation and providing voices to marginalised student groups (McLeod, 2011). The central argument of those who advocate utilisation of the student voice is that listening is intrinsically good. Not only does it enable teachers to learn from their students and garner information on the efficacy of curricula it also promotes a degree of equality (Adam et al., 2014; Cook-Sather, 2006; Seale, 2009; Bergmark & Westman, 2016; Cook-Sather, 2020). Listening to students ensures a shift of emphasis from a traditional paternalistic approach to education in which students are merely recipients of knowledge rather than active participants (Fielding, 2004). Promotion of the student voice is also emancipatory as Cook-Sather (2006) argues, it allows students to express their view and facilitates the realisation of their political potential serving to break down perceived authoritarian barriers between learners and teachers. Thus, promotion of the student voice respects students as individuals

who have the right to participate as citizens in their university and beyond. Another positive aspect of accessing the student voice is that it promotes and facilitates democratic dialogue in which tutors and students learn from one another. This contrasts with traditional didactic teaching which advocates a one-way system in which teachers teach, and students listen. This democratic approach is summarised by Cook-Sather (2006:367) thus “if students speak, adults must listen” and in doing so tutors can create curricula that counteract inherent inequalities and discrimination and promote learning that is based on respect for other and equity.

However, while the principles of the student voice are intrinsically good and aligned to a humanistic approach, such approaches may be viewed with suspicion by students. As Brooman et al. (2015) contend, the student voice in education only provides an illusion of equality, which fosters resentment among students. Any resultant data, therefore, is likely to be tainted and not a true reflection of their perspective. This is because the student voice as a concept has become synonymous with the collection of student feedback for quality control rather than to illuminate the students’ lived experiences (Mendes & Hammett, 2023). Young & Jerome (2020) refer to feedback through the student voice as managerialism, in which the mismatch of power between teacher and learner is reinforced rather than dismantled. Students, therefore, see no value in the feedback they voice and instead use the opportunity to penalise tutors for inadequacies in their teaching. Young & Jerome (2020) claim that this punishment is then reciprocated through marking, which ultimately strengthens the power differential between teacher and learner. Furthermore, feedback in the name of the student voice is arguably influenced by policy rather than a desire to be more democratic. Student feedback, for example, is ultimately sought to improve the quality of a university and is not

individualistic. Canning (2017) argues that this leads to universities filtering out comments they feel have external currency, in other words the student voice that promotes the standing of the institution, a process motivated by finance rather than pedagogy.

Accessing the student voice for purposes of feedback is also a macro rather than micro approach in which tutors treat students as a collective mass rather than as individuals. As Cook-Sather (2006) argues, the danger with pursuing the student voice is that we treat groups of students as a representing a single voice, i.e., “the student voice”, which will not truly describe individual and unique voices. This then leads to an over-simplification of the student experience, in which individuals can feel excluded or unrepresented because their experience does not tally with the majority, ultimately leading to feelings of misrepresentation and accusations of tokenism (Fielding, 2004).

With these criticisms in mind, when seeking the genuine student voice care must be taken to ensure that accusations of tokenism or resentment among participants are countered. The concept of ownership is of relevance here. Questions and questionnaires are written and designed by educators and often leave little room for self-expression. The student voice, therefore, is collected on the researcher’s terms and reflects their priorities, which leads to criticisms of ownership of information and distrust between students and researchers (Hall, 2017). Accessing the unencumbered student voice through unsupervised data collection methods can break down the educational hierarchies that separate researchers from their participants. Furthermore, allowing participants to discuss what they feel is important free from interruption ensures a degree of ownership of the data, thus reducing potential criticisms of mistrust and value in the findings.

3.7 The unencumbered student voice: A gateway to the hitherto unheard.

The idea of an unencumbered student voice is reflected in Seale's (2009) argument that the aim of using the student voice in education is to enable researchers and teachers to hear the hitherto unheard. Allowing students to speak freely can liberate perspectives and views that have been neglected or previously disregarded. Student nurses are ideally positioned to provide the insight required to shed light on the learning of the biosciences. Indeed, they should be viewed as experts in their field, their field being their experience of learning the biosciences and the environments in which they learn, i.e., the classroom and clinical practice.

However, while students are experts in their own learning, uncovering this knowledge can be impeded by perceived power dynamics between the tutor and the student, in what Canning (2017) refers to as difficulties with speaking truth to power. Despite all best efforts of tutors to create and maintain healthy working relationships a degree of control always remains. This is due to student perceptions of tutors as holding power over them. After all, tutors hold the keys to success in that they mark their assignments and write their job references. It is safe, therefore, to conclude that the risk of a muted, self-censored, or curtailed student voice remains a possibility. Reducing the impact of the power basis of the student – tutor relationship through unencumbered discussion would also facilitate a natural conversation, which Canning (2017) argues would allow researchers to access what he refers to as the irretrievable student voice, the opinions normally expressed far from the earshot of the tutor. Arguably accessing student conversations away from classrooms, where students feel they can truly express themselves free from fear of offending tutors would yield a much richer dataset. Canning (2017) cites hearing conversations that would provide a rich seam of data in café's, sports halls, public transport, and

campus libraries. Using conversations which researchers are not directly involved has no ethical basis of course, but engineering a conversation, like those that occur naturally among students to and from university, while studying, or eating, could lead to more naturalistic dialogue and more likely access to the irretrievable student voice. Canning (2017) acknowledges that any data gathered from student conversations is likely to be partial, fragmentary, imperfect, and possibly not at all useful. However, as Silverman (2013) maintains, the role of the qualitative investigator is to find the remarkable in the mundane and using unfacilitated focus groups that promote naturalistic conversations can generate data that uncovers significant concepts among often unexceptional discussion Furthermore, engineered conversations free from tutor influence will arguably provide more insight into the student experience than the rigorous and highly formalised traditional methods of qualitative data collection, i.e., interviews or focus groups.

3.8 Chapter summary and conclusions.

As discussed in Chapter 2 this thesis seeks to address two questions:

1) To what extent do the biosciences remain a cause for concern among contemporary adult-field students completing a BSc (Hons) Nursing programme?
2) What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?

Seeking to answer these questions provides an ideal opportunity to access the unencumbered student voice to access the lived experiences of contemporary student nurses, or more specifically the lived experience of students learning the

biosciences for forthcoming clinical practice. Chapter 4 will argue that focus groups provide the ideal forum for discussions on learning and experiencing a modern nursing curriculum. In deciding to make the focus groups self-directed and unsupervised was an attempt to minimise tutor influence and ensure resulting data is authentic and untarnished by interference, however unconscious that interference may have been.

This chapter explored the use of the unencumbered student voice as a gateway to the authentic unconstrained conversations, in which students are free from fear of retribution thus liberating a hitherto unheard voice. The decision to use unsupervised data collection is informed by humanism, humanistic psychology and humanistic research principles, especially the notion of unconditional positive regard. Having established an ontological position in this chapter and encapsulating the themes of the so-called “bioscience problem” in Chapter 2, the next step is to justify the chosen research methodology and design. Chapter 4 will argue that a mixed methods approach to data collection was the most appropriate way to answer research question 1 and 2 and that an interpretive phenomenological approach to data collection and analysis was required.

Chapter 4

Research methodology and methods of data collection

Chapter 2 provided an overview of the literature that suggests that the learning and teaching of the biosciences is problematic and raised several key issues which this thesis seeks to address. Student nurses experience difficulties learning the biosciences but the extent to which these difficulties apply to current students is unknown and an insight to the pedagogical reasons for these concerns is lacking. This chapter provides an overview of the research process that sought to answer those questions and seeks to justify the research design and rationalise the research focus, structure, and methodologies. The chapter will argue that a mixed methods approach to data collection was the most appropriate way to answer both questions, in that quantitative data ascertained through questionnaires provided an effective way of gauging current student opinion and that the use of focus groups to collect qualitative data produced a rich data set exposing their learning experiences. This chapter begins with a justification for an interpretive phenomenological approach to data collection and analysis.

4.1 Interpretive phenomenology.

According to Polit & Beck (2014) cognitive processing and exploration of concepts involves two intellectual mechanisms, namely inductive and deductive reasoning, and that the researcher's choice of either intellectual mechanism should reflect the nature of the research study. The testing of a theory or hypothesis, for example, suggests deductive reasoning, whereas studies that are purely investigatory require an inductive approach in which conclusions are drawn from

specific observations (Moule & Hek, 2011). Accepting a clear demarcation between inductive and deductive approaches is limiting. Ultimately, given the research questions posed, a mixture of both inductive and deductive reasoning was required. For research question 1 a deductive approach sought to prove or disprove the hypothesis that contemporary nursing students experience difficulties with learning bioscience, whereas the exploration of the student's perspective for question 2 suggests an inductive one.

Having decided to pursue both inductive and deductive approaches, exploration of theoretical frameworks that encompass both, action research and case studies for example, could have been deemed appropriate. Action research is primarily concerned with changing practice via a cyclical process, which involves assessment of a perceived problem, the planning of a change, implementation of change, and evaluation. One of the hallmarks of action research is its participatory nature, in which the researcher plays an integral role in the research process by taking an active part in the change process and recruiting colleagues as co-researchers (Parahoo, 2014). Unlike grounded theory action research attempts to alter the real world by identifying changes rather than formulating a new theory (Holloway & Galvin, 2017). Therefore, in terms of changing current educational practice the action research philosophy has much to commend it. Furthermore, the action research cyclical method is aligned to the nursing process (assess, plan, implement and evaluate) and would therefore have high currency among nurse educationalists (Parahoo, 2014). However, therein lay a potential obstacle. The focus of this study is the student experience and therefore action research would not be appropriate as it is arguably better suited to practitioners wishing to change their own practice.

Case study approaches could facilitate the investigation of a small group of students with a high degree of intensity and depth. However, this approach arguably works on the assumption that each student or case being studied is typical of other similar individuals, and that the findings from each individual case could provide insight into a wider student population. In this instance a small number of students could have been followed throughout their three years at university and beyond. Over time an intense and in-depth qualitative and quantitative dataset could have been gathered. Proponents of the case study approach argue that the ascertainment of such data is useful when exploring areas where little is known (Kumar, 2014). Given that little is known about the students' perspectives of learning the biosciences, a case study approach could have proved fruitful and informative. However, the collection of data through a case study approach is usually longitudinal and due to the protracted period, such studies are prone to drop-out and participant attrition (Parahoo, 2014).

The central tenet of inductive reasoning is that people are essentially different from things and therefore should be valued as individual unique beings. The role of the researcher is, therefore, to scrutinise patterns of behaviour and social interactions and try to make sense of what they observe from the perspective of the individual (Moule & Hek 2011). Common theoretical frameworks that reflect inductive logical reasoning include ethnography, phenomenology, and grounded theory. An ethnographical study would have sought to understand the beliefs, feelings, and behaviour patterns of students within the context of their culture or community. The principles of ethnography rely on the opposing emic and etic perspectives. As the purpose of ethnography is for the researcher to unravel and explore the individual's perceptions (the emic view), any interpretation would be

reliant on my ability to suppress my own perspectives (etic view) (Holloway & Galvin, 2017). By using an ethnographical approach, I could have absorbed themselves in the student nurse experience and observe their approach to learning bioscience, however as a recognised tutor this would have been problematic, and a phenomenological approach proved to be a more pragmatic solution.

Grounded theory as a method of data collection and data was discounted early in the research process because it arguably requires the researcher to commence with no clear hypothesis, and as argued in Chapter 2 this was simply not the case (Holloway & Galvin, 2017). As with both phenomenology and ethnography there is an emphasis on the viewpoint of the participant. However, the perspective is sociological as opposed to philosophical or anthropological. Its roots are in symbolic interactionism, which attempts to explain how individuals modify their behaviour by interpreting that of others (Holloway & Galvin, 2017). Pure grounded theory should lead to the formation of a new theory, which contrasts with phenomenology and ethnography in which the determination of themes and identified behaviours are the end point of the study (Moule & Hek 2011). Given that a primary concern of this research is the suitability of curricula in relation to effective learning of bioscience, the production of a pedagogical theory that explains the problematic nature of the biosciences was a desirable conclusion. However, accepting that there is an observed phenomenon (i.e., that modern students find bioscience problematic), it is arguable that commencing with no clear hypothesis is not possible.

Phenomenology like ethnography is an interpretivist reaction to traditional scientific approach to research. Unlike ethnography however, phenomenology has its roots in philosophy rather than anthropology. Phenomenology centres itself in the lived world and proposes that phenomenon should described or interpreted rather

than explained. The theory being that before any occurrence of an objective phenomenon, there is a subject who experiences it, therefore true knowledge is found in the origin of the experience. A phenomenological approach was apposite for this study, therefore, as it would allow me to explore the learning of bioscience in the context of a modern university setting from the student's perspective (Holloway & Galvin, 2017).

Also of note is the intended target audience of the research. According to Starks & Trinidad (2007), phenomenological research is most appropriate when the generated data will be of interest to clinicians and practitioners who need to understand the lived experience of a given phenomenon, in this case the lived experience of students completing a BSc in Nursing. As Newby (2014) states, phenomenology is concerned with human experiences rather than ideas and concepts ascribed to a given context. In this situation therefore phenomenology would seek to describe or interpret the student experience at the expense of the myths and perceived wisdoms that arguably influence the tutor perspective. Accepting that the problematic nature of the biosciences is an observable phenomenon, a phenomenological approach is an appropriate theoretical framework given it will facilitate the exploration of the lived experience of the student. As a research concept that stems from the humanistic research paradigm, phenomenology has a close association with my personal and social perspective (see Chapter 3).

Phenomenology, however, has variances in perspective and approach which are of relevance to this thesis, namely descriptive and interpretive phenomenology. Descriptive phenomenology, as developed by Husserl, seeks to portray the reality of the lived experience through observation and evaluation (Polit and Beck, 2014) and,

therefore, appears appropriate. For example, as Sundler et al., (2019) explain, our understanding of experiences is connected to the notion of intentionality of consciousness in which our conscious is always consuming experiences and, therefore, any experience we encounter has meaning. Polit and Beck (2014:271) refer to this as a phase of descriptive phenomenology, which they call intuiting, in which researchers seek to describe, define, and understand the experiences they witness. This approach is common among health researchers who seek to describe the lived experiences of individuals living with ill health (Sundler et al., 2019).

A key aspect of descriptive phenomenology is that the researcher must suspend their assumptions and presuppositions about the phenomena they are investigating, a process called 'Bracketing' (Polit & Beck, 2014). Husserl referred to this concept as "reduction" (Gill, 2020:75) in which the researcher purges or cleanses their mind of all pre-conceived notions so that the data is pure and what La Vasseur (2003:411) described as the "very essence of the phenomena". Such an approach, argues Christensen et al. (2017), is essential because we should only seek to describe experiences not to interpret them. As Holstein and Gubrium (1995) argue, research participants actively create meaning as they speak and therefore analysis should be treated as a narrated reality, in which data is locally produced and representative of their situation. To interpret what is observed we are imposing our own perspectives on another individual's experience and therefore risk making inaccurate inferences.

However, such an approach risks a mere description of the students' realities, which may not fully address the research questions. As Silverman (2010) highlights, descriptive approaches tend to report the participants' narratives or stories as facts, much in the same way journalists present confessional stories. This could render

the data one-dimensional and lacking depth. Stories or narratives expressed in data come from multiple personal perspectives. Silverman (2010) argues that there is no singular identity within our minds, and that people present various aspects of themselves depending on their situation. Rather than describing the data, therefore, analysis should include how ideas and concepts were expressed or generated and the consequences of their statements or arguments. Silverman (2010:225) refers to participants and researchers working in concert to generate plausible accounts of the world. This perspective is reflected in hermeneutics or interpretive phenomenology, which rejects the notion of bracketing as unrealistic.

Interpretive phenomenology was foundered by Heidegger, a student of Husserl, and concerns the central question of 'what is being?' (Polit & Beck, 2014). An influential concept for this thesis is Heidegger's notion that bracketing or "reduction" in analysis is simply not possible given that all individuals are culturally wedded to the world in which the observed phenomenon exists. Therefore, stepping outside of the experience is not an option. As Gill (2020) explains, there is no choice involved, the researcher is an integral part of the experience. Furthermore, hermeneutics assumes a degree of understanding of the witnessed experience of the researcher and that degree of understanding has value in that they are seeking knowledge that exists in a social situation or professional context (Benner and Wrubel, 1989). As such this ensures this approach is suitable for this research project.

4.2 A mixed methods approach.

Traditionally the quantitative and qualitative paradigms have been viewed as opposites (Florczak, 2014). From the quantitative paradigm perspective there is a world which exists beyond the perception human beings and that this world is only knowable if applied to immutable scientific laws. In contrast, proponents of qualitative research believe that there are an unknown number of social constructed realities, which do not necessarily conform to the laws of cause and effect (Polit & Beck, 2014). This disparity in research perspective is most apparent in healthcare where popular consensus is that the medical and pharmacological professions favour a quantitative and therefore empirical, positivist and reductionist approach to research. Whereas nursing research is predominantly qualitative and therefore interpretivist, naturalistic and humanistic (Parahoo, 2014). Typically, qualitative researchers have laboured under the rather pejorative label of “soft” sciences, with quantitative research methodologies being considered a more scientific endeavour that produces purer unadulterated and therefore more compelling data. This is reflected in the concept of evidence-based healthcare, in which there exists a hierarchy of evidence that suggests that quantitative based research, such as systematic reviews and randomised controlled trials have higher levels of kudos, rigour and worth in comparison to qualitative research (Dawes et al.,2004). This art versus science polarity, with a bias against qualitative research is mirrored in other professions, for example education, and social work (Newby, 2014; Carey, 2012) and has arguably become a part of nursing academic culture (Holloway & Galvin, 2017).

The roots of quantitative research lay in natural science and are based on the notion of positivism. Positivist research seeks to determine relationships between cause and effect by the examination of mathematical data. Positivists also rely on a

reductionist approach in which complex events and phenomena are reduced into simple observable units (Park et al., 2020). In both education and health observable phenomena are often unamenable to such cold objective observation. Therefore, rather than being pure positivism, quantitative research in education and health contexts can merely draw on its scientific basis and philosophy (Parahoo, 2014). Recent examples of this include Ortega-Galan et al. (2023) who used numerical attitude scales to measure nursing students' attitudes towards euthanasia and MacDonald et al. (2022) who used rating scales to measure the extent of incivility experienced by student nurses. As with this research, Ortega-Galan et al. (2023) and MacDonald et al. (2022) used numerical measure to assess the impact of phenomena arguably otherwise unmeasurable. In terms of determining the extent to which contemporary students struggle with the biosciences and therefore answer research question 1 "To what extent do the biosciences remain a cause for concern among contemporary students completing a BSc (Hons) Nursing programme?", a quantitative mode of inquiry utilising rating scales proved fruitful.

While it is generally recognised that quantitative research can yield objective data, its positivist and reductionist stance and reliance on empirical data is at odds with the social sciences, nursing academia and educational research (Carey, 2012; Newby, 2014; Holloway & Galvin, 2017). The argument being that the manifestation of student nurse behaviour is complex and, therefore, the sole use of empirical data based solely on what can be objectively measured renders the findings non-holistic, one-dimensional, and uninformative from a humanistic perspective. As Hasan (2016) argues, the positivism/reductionist position disregards an empathic understanding of phenomena from an individual perspective. In other words, the use of unambiguous numerical data to describe or explain a phenomenon does little to

illuminate the human perspective of the student nurse experiencing it. Measuring anxiety provides a good healthcare example of this view. Numerical rating scales were used to measure the impact of bioscience in terms of anxiety, but that data did not explain the source or nature of the anxiety. The numerical data, therefore, is somewhat simplistic and unsophisticated, and therefore unable to fully illuminate the students' lived experiences of learning bioscience. A qualitative approach to answering research question 2 "What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?", therefore, was deemed more appropriate. Qualitative research is a form of inquiry that seeks to explain how people make sense of the world they live in (Holloway & Galvin, 2017), and, therefore, ideal for the exploration of the lived experience of the contemporary student nurse studying bioscience. As Tomaszewski et al. (2020) argue, a qualitative approach facilitates a deeper examination of the lived experience, as opposed to making a prediction, and is ideal for new researchers exploring nursing and education among other fields that include human endeavour. Qualitative enquiry has a long tradition in both nursing and education and has recently been used to investigate students' perceptions of what constitutes nursing knowledge (Morrell-Scott, 2019) and student nurses' experiences of learning end-of-life care (Oba et al., 2023). In summary, a combination of both inductive and deductive reasoning was required to answer both research questions and, therefore, both a quantitative and qualitative mode of enquiry was employed. Using a mixed-methods approach was therefore pragmatic, focussed, and methodologically consistent.

4.3 The research setting and participants.

The participants of this research were all students completing a BSc (Hons) Nursing in a public university located in the South-East of England. It is a former polytechnic, achieving university status in 1992, and its educational portfolio is mostly vocational. In addition to courses in health and social care, the university offers degree programmes in education, engineering, computer science, business, law, and creative arts. This research took place within the School of Nursing and Wellbeing, which is situated in the Department of Health and Social Work. The school provides courses in all four nursing disciplines (adult, child, mental health, and learning disabilities) and provides both pre- and post-registration courses at both BSc and MSc level. The pre-registration BSc Adult Nursing programme is the largest course the school provides and has around 500 students enrolled at any one time. There are 50 whole-time equivalent (WTE) posts in the Adult Nursing Team and all employees are qualified nurses, registered with the NMC, who have extensive clinical experience.

The BSc (Hons) Nursing course is 3 years in duration and students spend 50% of that time in clinical practice, completing 7 assessed clinical placements of varying lengths, in a mixture of clinical settings. Their final placement is the longest, 12 weeks in duration, and culminates with their final clinical assessment in which an experienced nurse decides whether they practise to the standard expected of a qualified nurse. All the students taking part in the qualitative phase of this research were waiting to attend their final placement. The university's location ensures it is ideally placed to serve local NHS hospitals, community services, GP surgeries, and nursing homes. This ensures the students are exposed to a wide range of clinical areas and experience diverse levels of care both in institutions and in the patient's

home. All the clinical areas that student nurses visit and work in are audited to ensure that they are not only appropriate for learning, but they are also able to provide adequate support mechanisms for their students. NHS Trusts have education teams, which comprise of nurses who specialise in student support. The university also provides tutor support in the form of link tutors, who regularly consult with clinical areas to provide advice and guidance for staff nurses on how to manage and coach their students.

The main source of support, and for students the principal point of contact, was historically their "mentor." Mentor was the term used by the NMC to describe a nurse who has completed an approved mentor preparation programme (NMC, 2008). Mentors were responsible for the organisation and coordination of student learning activities, and for students, the main interface between the academia and clinical practice. In their final placement, students were allocated a "sign-off mentor," a "mentor" with greater experience and a proven history of assessment, who was responsible for assessing a student's suitability for autonomous clinical practice (NMC, 2008). In 2018 the NMC adjusted the focus of clinical support replacing mentors with practice assessors and practice supervisors. Practice assessors being responsible for the assessment of an individual student's progress and practice supervisors being responsible for coaching and support (NMC, 2018b). While practice assessors must be registered nurses, practice supervisors can belong to any health-related profession. Additional changes include the removal of recognised training for practice assessors and the introduction of academic assessors, designated tutors responsible for individual students. The change from a mentor-based system, and the introduction of practice assessors and practice supervisors occurred at the time of data collection, and the students in this study, therefore,

referred to their clinical colleagues as both mentors and practice assessors in the focus groups.

Whether referring to mentors or practice assessors, for students, these individuals are central to their learning and progress. While tutors are viewed as pivotal, mentors, sign-off mentors, and practice assessors are seen to be the key to success and qualification. It is sign-off mentors and practice assessors, for example, which determine a student's suitability to be registered as a staff nurse. It is sign-off mentors and practice assessors that students measure themselves against and use as a barometer for what constitutes an effective practitioner (Thomson et al., 2017).

4.3.1 Purposive sampling.

All 229 students that took part in this research were purposefully selected. This is justifiable because, according to Parahoo (2014), researchers should select the sample that best ensure they gather data appropriate to their research question. As section 4.1 argued, an interpretive phenomenological research method was employed and therefore, any participant should possess the experience and views that can help answer the research questions (LoBiondo & Haber, 2014). As Parahoo (2014) states, emphasis should be placed on what the participants can contribute to the research rather than what they represent. When examined from that perspective, a purposeful sample of students completing a BSc in Nursing is the obvious choice. Furthermore, I was mindful that as a new researcher, a pragmatic approach should be followed and that I should not seek to overcomplicate the research process. As a novice researcher I also followed the advice of Silverman (2010) who recommended nascent investigators begin in familiar territory and work

with data that is readily available or accessible so they can place their energies into analysis. Therefore, the decision was taken to take a pragmatic approach and explore the views of the students I encountered in class and worked with every day.

It is acknowledged that only using volunteers in this research could result in the validity of the findings being questioned. As Parahoo (2014) highlights volunteers may be conformist and using them ensures we know nothing about those reluctant to volunteer. However, as Newby (2014) argues, using volunteers is defensible in appropriate circumstances. For example, using volunteers can be useful when asking for curriculum to be appraised or when discussing sensitive topics. Furthermore, as discussed in Chapter 3, this thesis is based on the premise of the unencumbered student voice, and therefore, the use of volunteers enhanced the probability for engagement as students will feel free to fully express their views. While the participants of the focus groups were volunteers, they were specifically targeted because of their expertise. Only final year students were invited to volunteer as they were considered to possess the necessary experience of student life to make an appropriate contribution to the research. To that end, while they volunteered, they also represented a specialist group, which arguably justifies their inclusion (Newby, 2014).

4.4 Ethical approval and protection of the participants.

Ethical dilemmas are ubiquitous in qualitative research and risks to the wellbeing of participants are possible. This research was conducted in the knowledge of the tension described by Orb et al. (2001), which acknowledges that researchers must balance their desire to make recommendations for the good of

tutors and students and the need to maintain participant anonymity and potential harm. In determining which ethical principles are key to this research attention was paid to the common codes of ethical conduct, summarised by Silverman (2010:153) as being voluntary participation, protection of the research participants, assessment of the potential benefits and risks to participants, obtaining informed consent, and not doing harm. To that end, ethical approval was sought and granted on the understanding of the following principles. All students participated with no coercion or incentive to do so, and all participants gave signed consent prior to completing the questionnaire or taking part in a focus group. All questionnaires were completed anonymously, and completion was not compulsory. Potential participants could abstain from completion and could decide to withhold their questionnaire or decline to finish the questions once they had started. Participants in the focus groups were anonymised during transcription and as with the questionnaire gave signed consent before commencing. Please see appendices two, three, and four for examples of the questionnaires and the consent forms.

However, I was also acutely aware that ethical approval, so often the starting point of research, is not the end of ethical consideration. Shaw (2008) maintains that for many health and social researchers, the application for ethical approval is seen as an administrative issue, which is completed in the initial stages of a research project. Shaw (2008) argues that this rendering of ethical considerations to a procedural issue is based on an incorrect assumption that all ethical principles are the same for all social research projects. In seeking to reduce harm and ensure participants were treated equally it was recognised that this assumption is problematic for two interconnected reasons. Firstly, it assumes the researcher already knows the ethical impact and outcomes of their research before they start

collecting data and secondly, once the research project is underway the researcher's aims may change considering the data gathered, therefore the nature of the participants involvement and consent may also change (Shaw, 2008; Morina, 2020). Informed consent therefore was always considered to be continuous and reiterated throughout the focus group process, an approach Morina (2020) labels rolling or provisional consent. Therefore, close attention was also paid to the participants right to withdraw.

In executing this research, it was imperative to remain cognisant of the power differential between student and tutor (Orb et al., 2001). It is recognised that participants in qualitative studies are vulnerable to harm and through identification, breaches of confidentiality, and invasion of privacy (Peled & Liechtentritt, 2002). The power differential between students and tutor poses the potential for misrepresentation. This adds further weight to the ethical idea of continual informed consent discussed by Morina (2020). Analogous to the potential for misrepresentation is the risk of the potential benefits of this research not being equal to the potential harm the participants are exposed to (Peled & Liechtentritt, 2002). In other words, on completion of this thesis, would the participants accept or consider the impact of any benefits to be worth the risks they took to their psychological wellbeing when participating? To counteract this potential issue, I sought to promote the potential benefits of the research and ensure that the motivation to enhance student learning was clearly stated before and after the questionnaires were completed and the focus groups took place.

4.5 Research timeline.

This research was completed in three phases. During the first phase a pilot study was conducted that used a questionnaire to gather both quantitative and qualitative data on the students' perspectives on anxiety, subject complexity, and classroom time. In phase two enhanced questionnaires were used to collect data that sought to answer research question 1 "To what extent do the biosciences remain a cause for concern among contemporary adult-field nursing students completing a BSc (Hons) Nursing programme?" and in the third phase student-led focus groups were recorded and analysed to find the perspectives of contemporary nursing students in the final year of the BSc Nursing programme. This analysis sought to answer research question 2 "What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?" Table 4.1 summarises the research process, its stages, and aims.

	Dates	**Research questions addressed**	**Method**	**Participants**
Pilot study	26th June 2015	1 and 2	Questionnaire	42 student nurses
Quantitative phase	March 2017 – January 2018	1	Questionnaire	164 student nurses
Qualitative phase	10th May 2018 25th May 2018	2	Four unsupervised focus groups	23 student nurses

	19th October 2018 22nd October 2018			

Table 4.1 – Overview of the research process

4.6 The quantitative phase: The questionnaire.

During the quantitative phase questionnaires were used to determine whether the problematic issues highlighted in the literature were still apparent in a group of contemporary adult-field nursing students. The aim of the questionnaire was to answer research question 1 as well as the sub-questions (A – E):

1) To what extent do the biosciences remain a cause for concern among contemporary adult-field students completing a BSc (Hons) Nursing programme?

A) Is bioscience more likely to cause anxiety in adult-field nursing students than social sciences and nursing theory?

B) Is bioscience perceived to be more complex and challenging than social science and nursing theory by adult-field nursing students?

C) Do adult-field nursing students feel a need for an increase in bioscience classroom time?

D) Is bioscience still a valued part of nurse education for adult-field student nurses and how does this view compare with social science and nursing theory?

E) Do adult-field student nurses still regard bioscience knowledge as a determinant of effective nursing care and how does this view compare with social science and nursing theory?

The most common cited advantage of questionnaires is their ease of use, their efficiency, and their low-cost. Structured questionnaires, particularly those using closed-ended questions and rating scales provide a high degree of reliability due to their simplicity and lack of ambiguity (Parahoo, 2014). While this is a distinct advantage for this thesis their employment provides further benefits, namely in their intrinsic anonymity, which significantly reduces the chances of bias (LoBiondo-Wood & Haber, 2014). In this study for example, all the questionnaires were completed anonymously, with participants identified by a pre-assigned number. Such anonymity ensured a higher response rate as respondents were more conducive to participating knowing they were not identifiable.

Despite their simplicity and ease of use, questionnaires are largely recognised as producing superficial data. As Parahoo (2014) highlights, questionnaires leave little room for elaboration, even when using open-ended questions. There is no opportunity for further scrutiny or clarification, and often the numerical data that is retrieved has no context. Furthermore, while anonymity is inherent, probity is not guaranteed. As Jolley (2020) argues, people find it easier to be dishonest when completed a self-reported questionnaire, as often happens in questionnaires pertaining to lifestyle or health. This criticism can also apply to this research in which students may feel that their responses should acquiesce to what they perceive to be what I want to hear and therefore not their true opinion.

Despite the risk of falsehood, intentional or unconscious, the use of questionnaires was arguably appropriate for this research. As outlined in sections

4.1 and 4.2, the initial phases of this study were in essence a diagnosis of a problem. There would be little point in exploring the perceptions of the students regarding their learning if they themselves do not perceive a problem or challenge. Quantitative data obtained via a questionnaire provided a swift, dependable, easy, and therefore pragmatic method of making a diagnosis, which in this instance was whether elements of the bioscience problem were manifest in a contemporary cohort of students. Furthermore, as Parahoo (2014) argues, quantitative data obtained via questionnaires is easily analysed. The researcher was also confident of a large audience and therefore access to a substantial sample, which adds to the reliability of the data (Jolley, 2020).

4.6.1 Defining curriculum terminology.

The initial phases of the research were based on the premise that nursing curricula can be divided into three broad topic areas namely bioscience, social science, and nursing theory. Traditionally, nursing knowledge has been considered to embrace elements of biological, behavioural, and social sciences (Thornton, 1997). However, modern UK nursing curricula are shaped by the NMC and their standards of education. The 2010 NMC standards for pre-registration nursing, under the auspices of which data was collected, did not explicitly mention biological or behavioural science. Nurse education, it was stated, should guarantee “Adequate knowledge of the sciences on which general nursing is based.” (NMC, 2010:25). When defining the knowledge of what constitutes nursing knowledge the NMC stated the following topic areas as fundamental:

- professional, ethical, and legal issues,

- the theory and practice of nursing,
- the context on which health and social care is delivered,
- organisational structures and processes,
- communication,
- social and life sciences relevant to nursing practice,
- frameworks for social care provision and care systems. (NMC 2010:23)

Bioscience is implied by the term life science, and then to distinguish it from social science. While the term bioscience is absent from NMC guidance, it remains part of the nurse education lexicon, and while a variety of words are used (physiology, A & P, biology for example), there is a collective understanding of what the term bioscience implies, and which aspects of the curriculum tutors and students are referring to. Historically, nursing academics also use terms such as social science and nursing theory to differentiate other topics from bioscience or to make an argument that social sciences have priority (Jordan, 1994; Clarke, 1995; Wynne et al., 1997; McVicar & Clancy 2001; Courtenay, 2002; Fawcett et al., 2016). Social science is associated with anthropology, politics, history, and sociology, and it is the latter that informs nursing practice (Porter, 1996). In terms of the 2010 Pre-registration standards social sciences inform "the context in which health and social care is delivered", "organisational structures and processes", "social….science(s) relevant to nursing", and "frameworks for social care provision and care systems" (NMC, 2010:25). For this thesis, nursing theory encapsulates all theory related to nursing that does not explicitly relate to either bioscience or social science. This includes skills for nursing practice, as well as issues around professionalism and communication. In terms of the 2010 pre-registration standards nursing theory

informs “professional, legal and ethical issues”, “the theory and practice of nursing”, and “communication” (NMC, 2010:25).

The decision, therefore, to divide the curriculum into three broad topic areas was solely based on the common language used by both tutors and students. By using words such as bioscience, social science, and nursing theory, was to use terms that are recognisable and would need little interpretation by all participants.

4.6.2 The pilot study: Quantitative data.

A questionnaire was devised, which sought to address both research questions (see Appendix 1 for the complete questionnaire). It was divided into two parts, the first collected quantitative data and the second asked for qualitative responses. The first part consisted of 5 questions which sought to answer research question 1 and its 5 sub-questions (A – E). In questions 1 – 5, the students were asked to rank concepts of anxiety, difficulty, professional value, patient care, and classroom time in relation to the following 3 topic areas: bioscience, social science, and nursing theory. Taking anxiety as an example, for question one students were asked to rank the topic area that caused them the most anxiety as 1, and the topic area that caused them the least anxiety as 3. This process was then repeated for questions 2, 3, 4, and 5. To aid completion, this section of the questionnaire started with an explanation, using “Interest” as an example concept (see below).

Part One

Each question in this section relates to a different issue. For each question rank the topic areas in order of relevance to you. Below is an example, which demonstrates how to complete each question.

Interest

Rank all the following topic areas in terms of interest. For example, rank the subject area you find most interesting as 1 and the subject area you find least interesting as 3.

Bioscience *2*

Nursing Theory *1*

Social Science *3*

As you can see the above student finds Nursing Theory the most interesting, Bioscience the second most interesting and Social Science the least interesting.

Please complete the following 5 questions in the same manner

Question 1 – Anxiety

Rank all the following subject areas in terms of anxiety. For example, rank the subject area that you feel causes you the most anxiety as 1 and the subject area that causes you the least anxiety as 3.

Nursing Theory _____

Social Science _____

Bioscience _____

Question 2 – Difficulty

Rank all the following subject areas in terms of difficulty. For example, rank the subject area that you find most difficult to understand as 1 and the subject area that you find easiest to understand as 3.

Bioscience _____

Nursing Theory _____

Social Science _____

Question 3 – Professional Value

Rank all the following subject areas in terms of professional value. For example, rank the subject area that you feel has the greatest value to your professional development as 1 and the subject area that you feel has the least value to your professional development as 3.

Social Science _____

Bioscience _____

Nursing Theory _____

Question 4 – Patient Care

Rank all the following subject areas in terms of their impact on your patient care. For example, rank the subject area that you feel most informs your patient care decisions as 1 and the subject area that you feel has the least influence on your patient care decisions as 3.

Nursing Theory _____

Social Science _____

Bioscience _____

Question 5 – Classroom Time

Rank all the following subject areas in terms of ideal classroom time. Imagine you could determine the amount of time tutors spend teaching the following subject areas. Rank the subject area that you feel requires the most classroom time as 1 and the subject area that you feel requires the least classroom time as 3.

Bioscience _____

Nursing Theory _____

Social Science _____

To ensure the questionnaire was clear and unequivocal, the front page had a breakdown of what constituted bioscience, nursing theory, and social theory. This was to ensure clear demarcation between the subject areas. To further aid completion, students were given examples of which modules they would find each topic. See below:

To aid you, the table below lists examples of nursing topics for each subject area and the modules where they are normally taught.

Subject Area	*Examples of topics*	*Typical Modules*
Nursing Theory	*Nature and Ethics of the Profession.* *General Principles of Health and Nursing*	*Professional Aspects of Care* *The Healthy Adult* *Patient Centred Care 1* *Patient Centred Care 2* *Nursing Adults with Long Term Conditions*

		Transitions to Professional Practice
Bioscience	*Anatomy* *Physiology* *Pathophysiology* *Microbiology* *Pharmacology*	*Biological Basis of Health and Wellbeing* *Holistic Care of the Acutely Ill Adult* *Advanced Nursing Care of the Adult Patient*
Social Science	*Sociology* *Psychology* *Social and Health Legislation* *Legal Aspects of Nursing*	*Professional Aspects of Care* *The Healthy Adult* *Nursing Adults with Long Term Conditions* *Health Promotion*

The students were also asked to reiterate which of the three subject areas caused them the most anxiety before being given an opportunity to express why this was.

The pilot study questionnaire was completed by 42 students on 26th June 2015, however only 28 (66.67%) completed it correctly. Of the 14 students that did not complete the questionnaire as instructed 2 (4.76%) produced data that could not be processed and 12 (28.57%) changed their mind about which subject causes them the most anxiety. The 2 students that handed in questionnaires that did not produce useful data had failed to rank the subject areas in any order. The 12 students that

changed their mind about which subject causes the most anxiety did so due to a flaw in the questionnaire format.

4.6.3 The finalised questionnaire.

Considering the data collected in the pilot study, changes were made to the questionnaire. The finalised questionnaire also asked students to rank concepts of anxiety, difficulty/complexity, and classroom time in relation to bioscience, social science, and nursing theory. As with the pilot study the aim was to test the hypothesis that students find biosciences cause more anxiety than social science and nursing theory, is perceived to be more complex than social science and nursing theory, and that bioscience should have more classroom time than social science and nursing theory. However, asking students to rank subjects in terms of anxiety was arguably based on the assumption that students find their studies stressful. While there is evidence that this is the case (Turner & McCarthy, 2016; Munn, 2017) it stays an assumption nonetheless and to ensure a degree of rigour in the question, the option to opt out and state that none of the subjects induced anxiety, was added:

Question 1 – Anxiety

Rank all the following subject areas in terms of **anxiety**. For example, rank the subject area that you feel causes you the most anxiety as 1 and the subject area that causes you the least anxiety as 3. If none cause you any anxiety, please indicate this with a tick.

Nursing Theory _____

Social Science _____

Bioscience _____

None of these subject areas cause me anxiety _____

Furthermore, the term difficulty was considered too vague. On reflection, students could argue that all subjects are difficult. Learning how to insert a urinary catheter is difficult but as a task it is an uncomplicated process that can be broken down into a series of steps. While it is difficult to execute, it is arguably easy to learn the theory. In the aftermath of the pilot study the term complexity was added to question two, to suggest that students think about concepts they find intellectually challenging, rather than psychomotor skills that are demanding and need regular practice to perfect:

Question 2 – Difficulty and complexity

Rank all the following subject areas in terms of **difficulty**. For example, rank the subject area that you find most difficult to understand as 1 and the subject area that you find easiest to understand as 3.

Bioscience _____

Nursing Theory _____

Social Science _____

Questions 4 and 5 also seemed to be flawed. On reflection asking students to rank subject areas in terms of professional value and patient care was arguably unfair. The natural response was that all subject areas have value and have an impact on patient care, and therefore it is challenging for students to decide whether

one subject has more professional value or a greater impact on patient care than another. Furthermore, given one of the subject areas is nursing theory, it is difficult to argue that nursing theory is not fundamental to patient care. Therefore, rather than ask students to rank subjects, each subject was given its own sub-question in which students were asked whether they agreed with two statements. The term professional value was also thought rather woolly and open to interpretation. The question referred to professional development and aimed to encourage students to think about the value of subjects to their learning and their future practice. Therefore, the term professional value was removed and instead a more direct reference to education was made. In the final questionnaire, questions 4 and 5 asked the students to say whether they agreed or disagreed with 6 statements. They could select from a scale of responses ranging from “strongly agree” to “strongly disagree”. For question four the students were asked the extent to which they agreed or disagreed with three statements about the value of the three subject areas to their education. Below is an example about social sciences. The same statement was repeated substituting social science for bioscience and nursing theory, respectively.

“Learning the social sciences (sociology, psychology, social and health legislation, legal aspects of nursing) is an important part of a nurse’s education.”

Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree

For question five, the three statements all pertained to patient care, and again each statement related to bioscience, social science, and nursing theory, respectively. Each of the three statements started with *"Patient care can be enhanced if nurses have a good understanding of…"* followed by description of something indicative of bioscience, social science of nursing theory. For example, *"… the physiology and pathophysiology pertinent to the patient's past medical history and current state of health"* relates to the biosciences. For nursing theory, the following was added *"…the general principles of health and the nature and ethics of their profession"* with *"…social, psychological and legal aspects of health"* added for social sciences. The aim of these questions was to assess the hypothesis that students consider bioscience an important part of their education, and that bioscience knowledge is analogous to effective patient care. A comparison could also be made with their view of the importance of social science and nursing theory to their education and relationship between knowledge of social science and nursing theory and effective patient care.

Chapter 5 contains a detailed breakdown of the results from the quantitative phase of the study.

4.7 The qualitative phase: The focus groups.

The aim of this qualitative enquiry was to answer research question 2:

2) What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?

During the qualitative phase of this research unsupervised focus groups were used to gain insight into the lived experiences of a group of student nurses learning and using bioscience.

4.7.1 The pilot study: Qualitative data.

In the concluding section of the pilot study questionnaire, students were asked an open-ended question, which allowed them to express their reasons why they felt the subject they felt caused them the most anxiety, was anxiety inducing:

Question 2

Please give the reasons why you ranked the above subject area as most likely to cause you anxiety.

Analysis of the qualitative data produced by part two of the pilot study generated 24 keywords or themes (see Chapter 5). This suggested that a more in-depth investigation would yield a plethora of themes and keywords that would seek to answer research question 2.

4.7.2 The unsupervised focus groups.

As previously discussed, it was decided that unsupervised student led focus groups should be used to generate qualitative data to answer research question 2. A total of twenty-three final year student nurses participated in this phase of the study. Volunteers from the current 3rd year Adult Nursing cohort of students were sought and their willingness to participate was the sole basis of their selection (a break-down of the focus group participants can be found in Chapter 5). The participants

could choose which group to join from a list of dates and times and recruitment continued until each date and time was deemed full. The decision on what constituted a full focus group was based on the guidance of Marshall & Rossman (2016) and Wilkinson (2004), who advised between four and twelve participants, but ideally no more than eight. Fewer than four participants risked inadequate discussion, whereas higher numbers risked data being lost as people compete to be heard or else remain quite feeling unable to contribute (Marshall & Rossman, 2016). More students were invited than were needed in response to Wilkinson's (2004) advice, to mitigate the risk of students changing their mind or forgetting to attend. In the event, while some volunteers did neglect to attend on each occasion there were enough students to run a focus group.

According to Gray et al. (2016) researchers should take care when choosing the location of their focus groups and ensure they are comfortable, safe, and ensure privacy. Each focus group took place in the same location within the University. A meeting room used by both students and tutors was selected because of its relative seclusion. Access was via identification card only and could only be used if booked in advance. This ensured complete privacy for the duration of all four groups. The room contained a square formation of desks and ten chairs, normally used for meetings and tutorials. The square formation facilitated group discussion because the students could all see each another. In the middle of the desks was an I-phone and a windows phone, both of which were used to record the focus group. Two recording devices were used to ensure recording still occurred should there be a mechanical or functional failure. In the event no recording problems occurred, and the recordings made on the Windows phone were deleted. Each recording was

saved as a sound file and stored on a secure laptop and then erased from the researcher's phone.

Each group was asked to read the fictional academic assessment in the form of exam questions and discuss how the questions made them feel. The purpose of the questions was to function as a springboard for discussion, a way of engaging the students in a conversation about their experiences of learning the biosciences. The full set of questions can be found in appendix 4, but one example has been included below.

"Write an in-depth exploration of the pathophysiology of hyperthyroidism and its effect on metabolism. Include a detailed analysis of the physiological assessments a staff nurse should undertake in order to determine the impact of this disorder on a patient's cardiovascular and nutritional status."

No further instructions were given other than they were being recorded, and that researcher would return in 45 minutes to stop the recording. The length of the focus group was based on the guidance of Krueger & Casey (2015), who state that 45 minutes, although a short space of time, still represents a typical focus group, furthermore they advise shorter time frames for younger participants who run the risk of becoming more easily disengaged as time progresses.

Focus groups are an uncomplicated way of collecting qualitative data through the engagement of discussion by a group of individuals connected by a shared issue (Wilkinson, 2004). They provided an ideal method of collecting qualitative data that illuminated the student experience of learning the biosciences in part because of their innate capability to promote self-disclosure by capitalising on group discussion and group dynamics contained within a safe environment (Freeman, 2006).

Focus groups proved to be an efficient method of data collection. In conducting four focus groups data was gathered from 23 student nurses in a relatively short space of time (just over 3 hours). As Parahoo (2014) highlights, this is one of the key advantages of focus group research in that it allows researchers to reach significant numbers of people in a brief period. Furthermore, Quinn Patton (1990) contends that repeated focus groups ensure researchers can assess the extent to which there is a relatively consistent shared view among significant numbers of people. By repeating the focus group process four times, ensured a rich data set that enabled assessment of the key issues that described the student experience, issues that are discussed in Chapters 5 and 6.

The traditional view appears to be that focus groups are interviews of groups of individuals rather than group discussions (Quinn Patton, 1990). They are typically moderated by a researcher, whose key role is to facilitate discussion and ensure the conversation progresses (Parahoo, 2014). However, as Bowling (2023) and Wilkinson (2004) contend, researchers need not be rigid in how they execute their focus groups. Instead, researchers can be flexible and imaginative in their approach citing the use of games and exercises to stimulate conversation. It is for this reason fictitious assessment questions were used to encourage debate.

In addition to their pragmatism, focus groups also have several advantages over traditional interviews. As Wilkinson (2004) highlights, group interaction encourages participants to build upon the opinions and thoughts of others promoting a synergistic effect which leads to the generation of more elaborate accounts of issues. Furthermore, the generated synergistic conversations produced naturalistic and conversational data, which allowed me to hear how the student nurses habitually spoke and note the idioms, terminology, and vocabulary they used. Naturalistic

conversations also allow access to other forms of communication, such as joking, boasting, teasing, and anecdotes (Gray et al., 2016). This proved to be true for the focus groups in this study and arguably the generated data is closer to the truth as the students see or experience it because of that freedom of expression. Wilkinson (2004) describes this process as “structured eavesdropping” and contends that it provides rich data because the participants are more likely to reveal their true selves contrary to the widely held belief that research participants are prone to inhibition when discussing shared issues in public.

Many criticisms of focus groups centre on group dynamics and personalities. Focus groups run the risk of domination by confident participants at the expense of those who are reticent or shy (Bowling, 2023; Parahoo, 2014). As this research used unfacilitated focus groups it was important to be cognisant of this potential issue. However, the promotion of unencumbered discussion and the data it generated arguably outweighed the potential for some students feeling unable to contribute. In the event, all students were able to contribute to the group discussion (see Chapter 5).

One criticism of focus groups from a nursing perspective is the contention that focus group interviews are incongruent with a phenomenological approach. The basis of this criticism is that phenomenology is based on the perspective of individuals. As Webb & Kevern (2001) explain, in obtaining and analysing focus group data the researcher is basing their findings on a collective opinion which does not reflect every individual’s personal perspective. Only interviews can produce the uncontaminated data required. However, Bradbury-Jones et al. (2009) reject this view and highlight that through exchange of ideas the phenomenon being studied is enriched, producing new perspectives and ideas. This is in part facilitated by the

naturalistic conversation that is encouraged by the focus group format, in that it encourages freedom of expression (Parahoo, 2014). Allowing student nurses to freely express their opinions in turn can break down perceived hierarchical barriers between the tutor and student, especially given they were unsupervised. As Gray et al. (2016) accept, researchers can often commence studies with pre-conceived ideas which may influence the flow of conversation, allowing freedom of expression in safe and unsupervised space would overcome any potential unconscious researcher bias.

4.8 Thematic analysis.

The data produced by the focus groups was analysed using a thematic analytical approach. Thematic analysis is generally considered a generic analytical process (Holloway & Galvin, 2017). However, the approach to this analysis was informed by the work of Braun & Clarke (2006:79), who define thematic analysis as "a method for identifying, analysing, and reporting patterns (themes) within data". They further propose a six-step approach to analysis, which is to familiarise oneself with the data, generate specific codes, search for themes, review the themes, define, and name themes, and producing a report (Parahoo, 2014, Braun & Clarke, 2006). When analysing this data and determining themes, the work of Vaismoradi et al. (2016) was used as a guide. Vaismoradi et al. (2016) define a theme as an attribute, descriptor, element, or concept, which encapsulates groups of repeated ideas. Such themes could contain subthemes, which provide a comprehensive overview of the topic area. Vaismoradi et al. (2016) further argue that the data is not just a container of meaning, rather that the data contains several layers of meaning and only through a disciplined analytical process themes emerge.

A major criticism of thematic analysis is its lack of sophistication, lack of nuance, subtlety, and depth, and, therefore, only fit for those seeking a low level of inference (Sandelowski, 2010; Vaismoradi et al. (2016). However, as Braun and Clarke (2014) contend, such criticisms are incorrect as they assume the level of analytical thought and depth is uniform among all researchers. Braun and Clarke (2014) argue that thematic analysis can provide realism and depth if the analytical process is deliberative, reflective, and thorough. Their six-step approach, used in this research, provided a framework to ensure a more rigorous approach (Braun & Clarke, 2006).

The context of this research is the unencumbered student voice, generated through conversation. One could argue, therefore, that dialogical approach to analysis, such as conversation or discourse analysis would be apposite (Potter, 2004; Heritage, 2004). However, as the focus groups for this study were unwitnessed, facial expressions and body language could not be gauged. Furthermore, how the students interacted with one another is arguably a distraction from the main aim of this thesis, which is to gauge their lived experiences, adding further weight to the use of thematic analysis. As Sundler et al. (2019) contend, thematic analysis enables researchers to uncover and explore the lived experiences of others if the data has been generated via their narrative, as is the case in this research. Thematic analysis is also congruent with the philosophies of nursing practice and remains a common approach in nursing and healthcare as it facilitates the extraction of data that illuminates the lived experience (Matua, 2015). Indeed, thematic analysis using the six-step process advocated by Braun and Clarke (2006) remains a constant in nursing (Varagona & Hold, 2019; Bruce et al., 2023) and education research (Finkelstein et al., 2021; Barnard et al., 2022).

In analysing naturalistic data, it was important to avoid potential criticisms of researcher bias and the production of contrived data. For instance, I was conscious of the possibility that the thematic analysis of the focus group data could be construed as hypothesis driven, which would lead to what Kromrey (1993:25) referred to as “data trimming and cooking”. This term describes the deliberate discarding of data that does not fit the working hypothesis. Conversely, a further criticism could be that data was cherry picked, and emphasis placed on quotes that reflect the researchers thinking and perspective. Silverman (2010) recommends using quality control measures to bolster interpretation of qualitative data. Counting the frequency of ideas or concepts for example, could have been used to reinforce data interpretation. However, as Sim (1998) argued, expression of ideas may be reflective of the pattern of interaction that occurred in the unique context of the focus group. Attempts to quantify utterances of specific words or phrases, therefore, may be misleading. Furthermore, it is the strength of opinion and its emphasis that is an arguably more valid measure of impact and importance. Another possible method of ensuring quality control is to repeat the focus groups, as occurred in this research (Silverman, 2010). However, as Sim (1998) further argues, each individual focus group generates data that is unique to the context of that group and the unique lived experiences of its participants, comparing strength of feeling between groups is, therefore, problematic. However, multiple groups did enable comparison of the range of views and perspectives the students voiced.

Another area of concern is the weight of importance placed on views and perspectives that were voiced by single individuals. However, exploring reaction and interaction in the conversations facilitated the assessment of strength of feeling, and participants responses to individual opinions reinforced the significance of these

singular ideas. When analysing the data, dissenting voices, or the lack of them provided insight into the relevance of specific comments. As Sim (1998) contends, conformity of opinion is key. Conformity of opinion can be viewed as a property of an individual focus group, rather than an aggregation of individual perspectives. Analysing how the group responded and how the conversation flowed provided insight into the strength of feeling and the significance of individually expressed ideas to others in each group.

Finally, when analysing the focus group data, I was cognisant of the notion that it is arguable that no data are intrinsically unsatisfactory (Silverman, 2013:50). In their argument that a polemical approach to data, which is the dividing data into that which is “good” and that which is “bad” Silverman (2013) states that it is not how you find the data, it is how it is used that is important. This is arguably true for focus group data, which has the potential for criticisms of bias. For instance, Silverman (2013) further argues that when analysing data, researchers should treat individual and collective dialogue as an expression of identity, and that statements made during data collection, therefore, constitute an activity to be analysed rather than a picture in need of a commentary.

4.9 Chapter summary.

This chapter argued that using a mixed-methods approach will answer research questions 1 and 2. A questionnaire collecting quantitative is an appropriate way to establish that historical claims relating the bioscience’s relationship with anxiety, complexity, and perceived paucity of classroom time as well as the value placed on bioscience remain relevant. A qualitative approach is also an appropriate

method to establish the learning experiences of student nurses studying bioscience. The next chapter will describe the results of both the quantitative and qualitative phases of the study and discuss the extent to which the research questions have been answered. Chapters 6, 7, and 8 will analyse and discuss the findings in detail and explore the implications for nurse education both in classrooms and in practice.

Chapter 5

The questionnaire and focus groups: A description of the findings

This chapter describes the research findings in relation to each of the research questions. It includes a description the findings of the pilot study, the questionnaire, and the focus groups and will conclude that the data collected in all three phases collectively answer both research questions. The pilot study and the questionnaire successfully measured the extent to which student concerns about the biosciences remain for a contemporary group of students in terms of anxiety, perceived complexity, and classroom time. These findings also confirm that for this group of students the biosciences remain valuable and integral to patient care and that the students' perspectives on the biosciences are more favourable than social sciences and nursing theory. This chapter will also argue that data from the focus groups answers research question 2 and that this data describes the student perspective and experience as six distinct concepts, which are indispensability, deficiency, burden, angst, reality, and identity.

5.1 Research question 1.

This section describes the data generated by the questionnaires distributed between March 2017 and January 2018 and argues that the quantitative expression of the students' views on anxiety, perceived complexity, and classroom time answer the first research question:

1) To what extent do the biosciences remain a cause for concern among contemporary adult-field students completing a BSc (Hons) Nursing programme?

This section also describes a numerical analysis of the value students place on bioscience, social science, and nursing theory in terms of education and patient care. It also describes the data from the pilot study because its results reinforce the findings of the main questionnaire and strengthens the argument that research question 1 has been answered.

5.1.1 The pilot study findings.

As discussed in Chapter 4, 28 (66.67%) of the 42 participants in the pilot study completed the questionnaire correctly. An overwhelming proportion of those 28 students ranked bioscience as the most likely subject area to cause anxiety and the most difficult to learn. Three-quarters (n = 21) ranked bioscience as the most anxiety inducing subject area (see table 5.1) and in relation to perceived subject difficulty 23 (82.14%) of students ranked bioscience highest (see table 5.2).

Question 1 – *Rank the following subject areas in terms of anxiety. For example, rank the subject area that you feel causes you the most anxiety as 1 and the subject area that causes you the least anxiety as 3.*			
Subject Area	**1**	**2**	**3**
Bioscience	21 (75%)	3 (10.71%)	4 (14.29%)
Nursing theory	4 (14.29%)	7 (25%)	17 (60.71%)
Social science	3 (10.71%)	18 (64.29%)	7 (25%)

Table 5.1 – Student responses in relation to anxiety.

Question 2 – *Rank the following subject areas in terms of difficulty. For example, rank the subject area that you find most difficult to understand as 1 and the subject area you find easiest to understand as 3.*			
Subject Area	**1**	**2**	**3**
Bioscience	23 (82.14%)	3 (10.71%)	2 (7.14%)
Nursing theory	1 (3.57%)	12 (42.86%)	15 (53.57%)
Social science	4 (14.29%)	13 (46.43%)	11 (39.29%)

Table 5.2 – Student responses in relation to difficulty.

In terms of the value of subject areas to professional development most respondents identified nursing theory as the most important (n = 19, 67.86% - see table 5.3). A greater proportion of students stated that nursing theory was also the most important in relation to informing their nursing care decisions (n = 24, 85.71% – see table 5.4). For both professional values and patient care bioscience came second by a considerable margin. No student ranked social science as the most important to their professional development or patient care decisions.

Question 3 – *Rank the following subject areas in terms of professional value. For example, rank the subject area that you feel has greatest value to your professional development as 1 and the subject area that you feel has the least value to your professional development as 3.*			
Subject Area	**1**	**2**	**3**
Bioscience	9 (32.14%)	11 (39.29%)	8 (28.57%)
Nursing theory	19 (67.86%)	5 (17.86%)	4 (14.29%)
Social science	0 (0%)	12 (42.86%)	16 (57.14%)

Table 5.3 – Student responses in relation to professional value.

Question 4 – *Rank the following subject areas in terms of their impact on patient care. For example, rank the subject area that you feel most informs your patient care decisions as 1 and the subject area that you feel has the least impact on patient care decisions as 3.*			
Subject Area	**1**	**2**	**3**
Bioscience	4 (14.29%)	14 (50%)	10 (35.71%)
Nursing theory	24 (85.71%)	3 (10.71%)	1 (3.57%)
Social science	0 (0%)	11 (39.29%)	17 (60.71%)

Table 5.4 – Student responses in relation to patient care.

Question 5 asked students to imagine they could determine the amount of classroom time tutors spent delivering the three identified subject areas. Twenty-two students felt that there should be an increase in the curriculum time devoted to bioscience (78.57%) – see table 5.5.

Question 5 – *Rank the following subject areas in terms of ideal classroom time. Imagine you could determine the amount of time tutors spent teaching the following subject areas. Rank the subject area that you feel requires most classroom time as 1 and the subject area that you feel requires the least classroom time as 3.*			
Subject Area	**1**	**2**	**3**
Bioscience	22 (78.57%)	3 (10.71%)	3 (10.71%)
Nursing theory	6 (21.43%)	14 (50%)	8 (28.57%)
Social science	0(0%)	11 (39.29%)	17 (60.71%)

Table 5.5 – Student responses in relation to classroom time.

Collectively, this data highlights that for this group of students, bioscience is a cause for concern in terms of anxiety, difficulty, and classroom time. However, the small sample (n=28) rendered these findings indicative and confirmed that a much larger sample size was needed to ensure validity (Parahoo, 2014). The pilot study

data also highlighted that despite not ranking bioscience as being the most important in terms of professional value and patient care decisions, having a rigorous understanding of bioscience was still deemed a valuable aspect of being a professional nurse. This notion of bioscience being of value to professional practice was a theme that re-occurred in the main questionnaire and the focus group data.

The final part of the pilot study asked students to reiterate which of the three subject areas caused them the most anxiety and then asked them to express in their own words why this was. Analysis of the qualitative data produced by this final question generated 24 keywords or themes, which could be sub-divided further (see table 5.6). Responses suggested that bioscience was applicable to their chosen career, however a plethora of themes emerged from the data suggested they considered bioscience to be the most anxiety inducing subject area. Also highlighted were issues beyond the tutor's control, curriculum design and timetabling for example. Less common themes centred round the enjoyment of subjects or conversely a lack of enjoyment with subjects being identified as not being a favourite. By triangulating the key themes generated from the qualitative data it was possible to match or group themes into categories that are attributable to key student focussed aspects of the "bioscience problem," i.e., anxiety, complexity, professional value, patient care, and classroom time (see table 5.7).

Keyword	**Code**	**Identifying factors**	**Keyword**	**Code**	**Identifying factors**
Application	App1	Subject does not apply to my career	Knowledge	K2	No prior or previous knowledge of subject area before commencing course
Anxiety	Ax1	Subject causes anxiety		K3	Assumed knowledge/understanding on part of tutors
Challenging	C1	Subject is challenging	Memory	M1	High volumes of information to remember

Curriculum	Cm1	Curriculum structure disrupts learning of subject	Overwhelming	O1	Subject is overwhelming
Complexity	Cx	Subject is complicated	Pressure	P1	Subject causes pressure
Difficulty	Df1	Difficulty – subject difficult	Patient Care	Pc1	Knowledge of subject enhances care
	Df2	Difficult/hard to apply to practice		Pc2	Lack of knowledge of subject endangers patient's wellbeing
Depth	Dp1	More depth required in comparison to other topics		Pc3	Need to understand subject as dealing with real lives
	Dp2	Subject required depth (no mention of other topics)	Responsibility	R1	It is a nurse's responsibility to know this subject
Enjoyment	E1	Subject is enjoyable		R2	Nurses are relied upon therefore need to be knowledgeable
Favourite	Fv1	Subject is not my favourite	Speed	Sp1	Subject rushed – content delivery too quickly
Helpful	H1	Subject is helpful to practice	Time	T1	Not enough time spent on subject
Intricate	I1	Subject is intricate		T2	Too much time spent on subject
Important	Imp1	Subject is important		T3	Time spent on this subject would be better served studying something more useful
Influence	Inf1	Subject has influence on learning	Timetable	TT1	Time tabling disrupts learning
Intensity	Int1	Subject produces intense learning	Volume	Vol1	High Volume of information to learn
Knowledge	K1	Elevated level required	Work	W1	More work required (in comparison to other subjects)

Table 5.6 – Keywords and themes (and attributed codes) generated by question 5 of the pilot study.

Area of concern	**Theme/Keyword**
Anxiety	Anxiety
Difficulty	Challenging Complexity

	Difficult Depth Intricate Intensity Knowledge Memory Pressure Work
Professional Value	Helpful Importance Responsibility
Patient Care	Patient Care
Classroom Time	Speed Time Volume

Table 5.7 – Triangulation – Keywords and Themes matched with the 5 key areas of concern.

Very few indicated that nursing theory and social sciences were the most anxiety inducing subjects and therefore no noteworthy data relating to their impact was generated. Most students highlighted bioscience as the most likely subject to cause them anxiety and the data described the impact of bioscience in terms burden, volume of information, difficulty, and a lack of classroom time. For some, the burden of needing to be knowledgeable in bioscience in order to be a safe practitioner was a contributory factor.

"Bioscience gives me the most anxiety as I feel that I have to be more aware of what danger are (sic) happening to the patient's physiology" – student PS7.

It is also clear that students find bioscience challenging in comparison to nursing theory and the social sciences. Key themes that emerged from the qualitative comments centre on terms such as "difficult," "intensity," "complexity," and "intricacy." Students described modules with bioscience content as being challenging because of their intricate and complex nature.

"I feel that the modules with in (sic) Bioscience are the most challenging and difficult" – student PS12.

There was a sense that the volume of information that students need to digest to understand bioscience topics is greater than nursing theory and social science topics. This was often expressed in terms of subject depth and work effort – suggesting that more time, effort, and dedication is required to succeed in bioscience assessments.

"Bioscience is really helpful in learning the disease process and relating it to the signs and symptoms of patient but at the same time it needs in depth analysis" – Student PS2

Other students choose words such as "pressure" and "intensity" to describe their experience of dealing with bioscience.

"I must be knowledgeable in anatomy and physiology, thus giving me more pressure and anxiety" – Student PS6

"These modules [containing Bioscience] are intense learning" – Student PS15

In terms of professional values and patient care students reflected upon bioscience being vital in ensuring that they maintain optimum patient care. This notion was expressed with terms such as "helpful" and "important." There was also

a sense that students should concentrate on bioscience as it is their responsibility to be as knowledgeable as possible.

"Science is not one of my favourite areas but while I am studying in nursing, I am aware this plays an important part, it will have a great influence to my learning in Adult Nursing" – Student PS26

Such ideals tie in with the student's need to ensure that patient care is enhanced, and patients are protected. There are two intertwined concepts that were highlighted by the data. The first was that bioscience enhances patient care decisions, especially in acutely ill patients at risk of deterioration. The second concept was that a deficit in bioscience knowledge could lead to patient harm.

"I have to be more aware of what changes are happening to the patient's physiology. I feel that having all the Bioscience knowledge is the one that underpins my nursing care" – Student PS7

"I feel this [Bioscience] is a very important subject area in nursing. There's not really any room to get things wrong" – Student PS28

Issues surrounding classroom time were also prevalent in the data. Key factors include the speed at which bioscience subject matter is taught as well as chronological time. Students described their experience as one of high volumes of material delivered very quickly in short spaces of time.

"Rushed Learning, not spent time relating to how we use (sic) [Bioscience]. A lot to learn, hard to understand" – Student PS10

"Biological systems are skipped over too quickly" – Student PS20

Twelve participants changed their mind on which subject caused them the most anxiety and were omitted from the above analysis. However, scrutiny of them

produced further interesting findings. In changing their mind about which subject causes the most anxiety over 66% (66.67%) changed from nursing theory or social science to bioscience and only 2 changed from bioscience to either nursing theory or social science (see table 5.8). This suggested that 8 further students had intended to rank bioscience as the most likely to cause anxiety in question 1 or that the completion of the questionnaire had led them to reflect on this issue and a reversal of decision occurred.

Student changed to….	**Number (%)**
Bioscience	8 (66.67%)
Nursing theory	2 (16.67%)
Social science	2 (16.67%)

Table 5.8 – Number of students that changed their initial preference in question 1.

Mapping the results against the selected key student focussed aspects of the bioscience problem suggested that potentially it remains relevant for the students that completed the pilot study. For most students (75%) bioscience was more likely to cause anxiety than social science or nursing theory. This point is reinforced with the inclusion of the 8 students that changed their preference to bioscience as the most anxiety inducing subject. Likewise, a substantial proportion found bioscience (82.14%) the most difficult to understand and felt that it requires more classroom time (78.57%).

Analysis of the qualitative data however demonstrated that not only is there mileage in the assertion that modern students find bioscience anxiety inducing, difficult and in need of more classroom time, there was also evidence that students

considered bioscience to be important to their professional practice. Analysis of the qualitative data generated keywords that correlated with this outlook. Words such as challenging, complexity, difficult, depth, intricate, intensity, knowledge, memory, pressure, and work, were all used to justify why bioscience causes anxiety and all arguably reinforced the notion that bioscience is a taxing and problematic topic area. Qualitative responses also suggested that anxiety was heightened by insufficient classroom time. Student responses also suggested that the speed of delivery and high volumes of data delivered in short spaces of time added to their anxieties, which correlated directly with the student focussed aspect of the bioscience problem relating to classroom time. The qualitative data also reinforced the concept of bioscience being of significant value in terms of a student's professional practice. Terms such as helpful and important suggested a recognition that an understanding of bioscience aids and enhances patient care and reference to responsibility suggested that students felt it was their responsibility to be as knowledgeable as possible.

Finally, the data generated in pilot study provided a snap-shot assessment of the students' perspectives of studying bioscience and it provided a stimulus to pursue a qualitative investigation into the student's perspective of their learning of bioscience with the confidence that the problems associated with this topic area, discussed in Chapter 2, were still a relevant cause for concern.

5.1.2 Questionnaire findings.

In total 164 questionnaires were returned. The sample was representative of the student body with a distribution of males and females that is analogous with the

nursing workforce (see table 5.9). The number of non-white students completing the questionnaire was greater than the current UK nursing workforce but was comparable to the study body at the time of data collection (see table 5.10). The students completing the questionnaire were aged between 20 and above 50 years old, with the majority being aged between 21 and 29 (see table 5.11).

	Number	Percentage	UK average*	University average
Male	20	12.19%	11%	12.26%
Female	144	87.81%	89%	87.74%
Totals	164	100%	100%	100%

Table 5.9 – Proportion of male and female students. * Based on Nursing and Midwifery Council Data (NMC, 2023b).

	Number	Percentage	UK Average*	University average
White	86	52.44%	69.4%	33.33%
Non-white	78	47.56%	30.6%	66.67%
Totals	**164**	**100%**	**100%**	**100%**

Table 5.10 – Proportion of white and non-white participants. * Based on Nursing and Midwifery Council Data (NMC, 2023b).

Age range	Number	Percentage
20 or younger	30	18.29%
Between 21 and 29	70	42.68%
Between 30 and 39	35	21.34%
Between 40 and 49	21	12.80%
50 or older	5	3.05%

Declined to give age	3	1.83%
Totals	**164**	**100%**

Table 5.11 – Age range of participants.

From a total 164 completed questionnaires, 11 were either incomplete or had been completed incorrectly and were disregarded. Therefore, this chapter is based on the analysis of 153 completed questionnaires.

The quantitative results for questions anxiety, perceived complexity and classroom time are detailed in tables 5.12, 5.13 and 5.14.

Subject area	**Ranked 1**	**%**	**Ranked 2**	**%**	**Ranked 3**	**%**
Bioscience	65	42.48%	39	25.49%	40	26.14%
Nursing Theory	42	27.45%	50	32.68%	52	33.99%
Social Science	37	24.18%	55	35.95%	52	33.99%
No subject caused anxiety	9	5.88%				

Table 5.12 – Breakdown of rankings for anxiety.

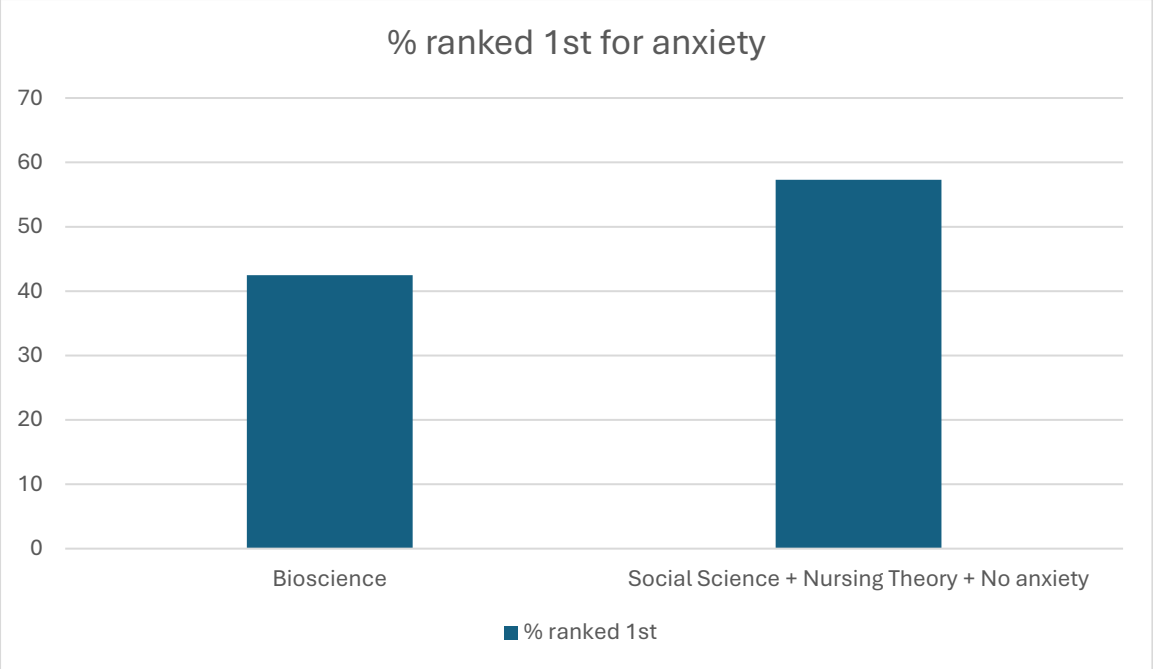
Subject area	**Ranked 1**	**%**	**Ranked 2**	**%**	**Ranked 3**	**%**
Bioscience	80	52.59%	34	22.22%	39	24.49%
Nursing Theory	36	23.53%	57	37.25%	60	39.22%
Social Science	37	24.18%	62	40.52%	54	35.29%
Social Science and Nursing Theory	73	47.71%	119	77.78%	114	74.51%

Table 5.13 – Breakdown of rankings for complexity.

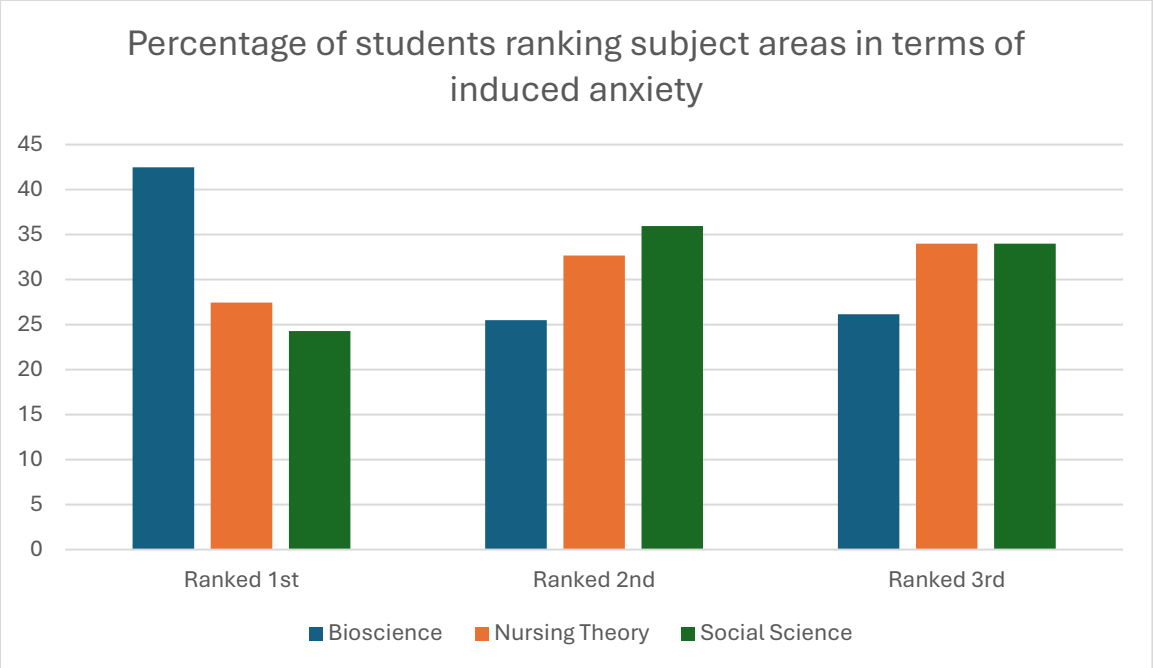
Subject area	Ranked 1	%	Ranked 2	%	Ranked 3	%
Bioscience	118	77.12%	26	16.99%	9	5.88%
Nursing Theory	27	17.65%	70	45.75%	56	36.60%
Social Science	8	5.23%	57	37.25%	88	57.52%
Social Science and Nursing Theory	35	22.88%	127	83.01%	144	94.12%

Table 5.14 – Breakdown of rankings for classroom time.

More students ranked bioscience first for anxiety than for social science and nursing theory. This suggests that for this group of students, bioscience is the subject area of the three cited to most likely to cause anxiety. However, while 42.48% of students ranked bioscience as the most likely to cause anxiety, 57.52% did not. Most students chose something other than bioscience, for instance 27.45% ranked nursing theory as number 1 and 24.18% ranked social science the highest. A further 5.88% stated that none of those subject areas caused anxiety (see graph 5.1). Therefore, while bioscience was the most popular choice, any claim that it is a key issue amongst the student population could be open to criticism. However, the number of students that ranked bioscience as being the second or third most likely to cause anxiety was much lower than for both social science and nursing theory (see graph 5.2).



Graph 5.1 – Students ranking subjects in terms of anxiety. Bioscience compared with social science, nursing theory and students indicated no anxiety combined.



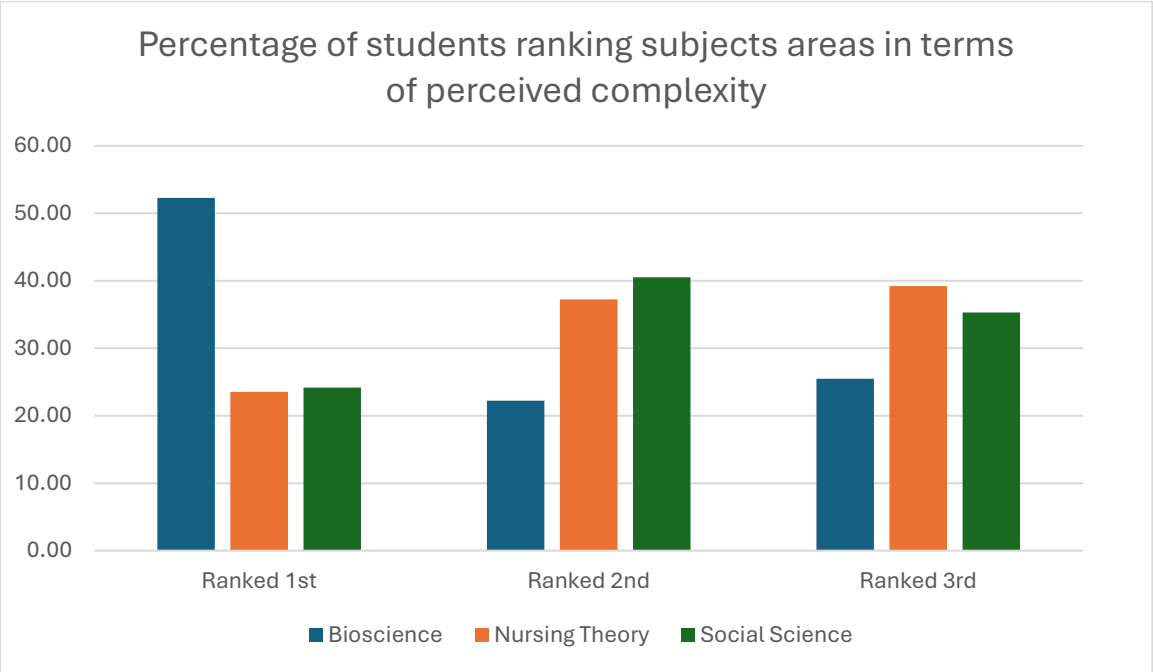
Graph 5.2 – Students ranking subjects in terms of anxiety. Bioscience compared with social science and nursing theory.

There was a significant difference in students indicating that bioscience was most likely to cause anxiety in the pilot study than in the large-scale study. In the small sample pilot study, 75% of respondents selected bioscience as the most anxiety inducing subject area. However, in the large-scale study of 164 students, fewer respondents selected bioscience (42.48%). This suggests that the notion that bioscience is the most likely topic area to cause anxiety is not as acute as anticipated. However, it is arguable that bioscience can be problematic and complex in the absence of anxiety. For example, as will be discussed in sections 5.2.3 and 5.2.4 the data for perceived complexity and desire for more classroom time clearly suggests that bioscience is considered more complex and has insufficient time dedicated to it, in comparison to social science and nursing theory. Furthermore, as sections 5.2.5 and 5.2.6 highlight, there is also a bias towards bioscience in terms of its value in education and patient care, albeit marginal. These phenomena arguably suggest that bioscience is viewed as being problematic among the student population, even among students that may not associate it with anxiety.

Therefore, in answer to sub-question A “Is bioscience more likely to cause anxiety in adult-field nursing students than social sciences and nursing theory” this data indicates there is a tendency towards bioscience and that overall bioscience remains the most troublesome topic area in terms of anxiety, if only by a small margin.

The most common subject area to be ranked 1 for complexity was bioscience, with 52.59% of respondents ranking it higher than social science and nursing theory. Indeed, more students selected bioscience as number 1 than social science and nursing theory added together (collectively 47.71%). Furthermore, there is a distinct difference in subjects ranked 2 and 3. Approximately three quarters of students

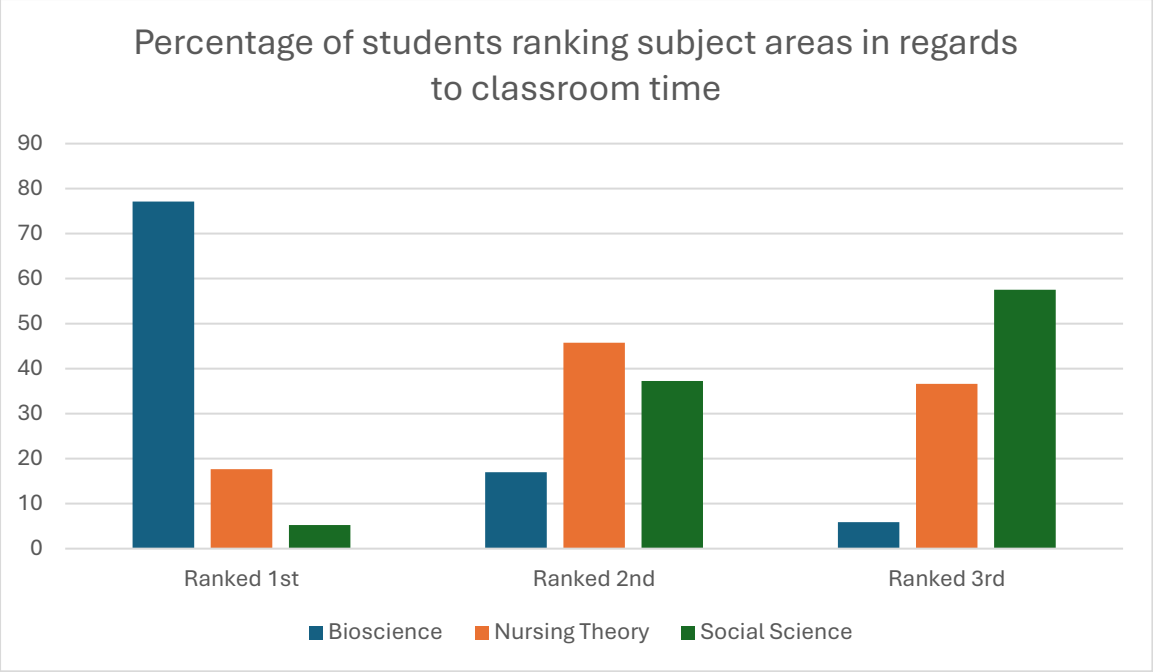
ranked nursing theory and social science as second or third compared to around a quarter of students selecting 2 or 3 for bioscience (see graph 5.3).



Graph 5.3 – Students ranking subjects in terms of perceived complexity.

Therefore, in answer to sub-question B “Is bioscience perceived to be more complex and challenging than social science and nursing theory by adult-field nursing students?” this data validates the notion that bioscience is perceived to be more complex than nursing theory and social science.

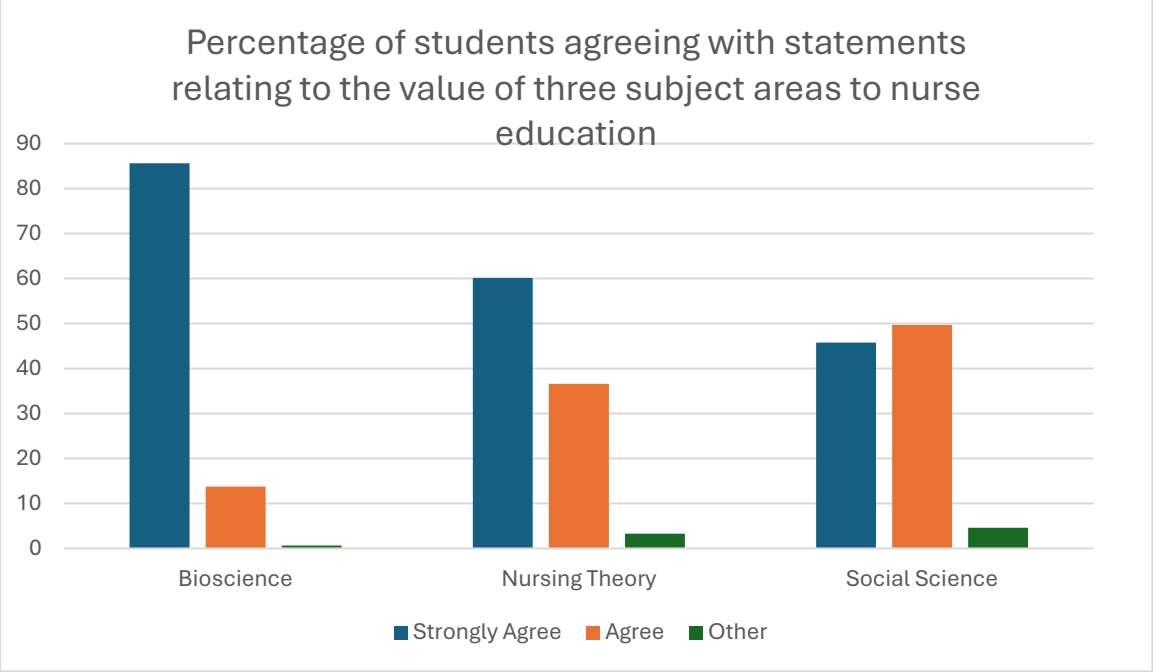
The subject area considered in need of the most classroom hours was bioscience (77.12%), followed by nursing theory (17.65%) and social science (8, 5.23%). A greater number of students selected bioscience as number 1 (118, 77.12%) than social science and nursing theory added together (35, 22.88%). There was also a distinct difference in subjects ranked 2 and 3. Over 80% of students ranked nursing theory and social science as second and over 90% ranked them third (see graph 5.4).



Graph 5.4 – Students ranking subjects in terms of classroom time.

Therefore, in answer to sub-question C "Do adult-field nursing students feel a need for an increase in bioscience classroom time?", this data confirms that most students do feel that more classroom time should be dedicated to the biosciences, in comparison to social science and nursing theory.

As expected, students had a positive view of all three subject areas in terms of their value in nurse education. All students agreed with statements that bioscience, social science, and nursing theory were important to nurse education with 99.35% strongly agreeing or agreeing that bioscience was important, 96.73% strongly agreeing or agreeing that nursing theory was important and 95.42% strongly agreeing or agreeing that social science was important. However, greater numbers of students indicated that they strongly agreed that bioscience (85.62%) was important in nurse education than nursing theory (60.13%) and social science (45.75%), see graph 5.5.

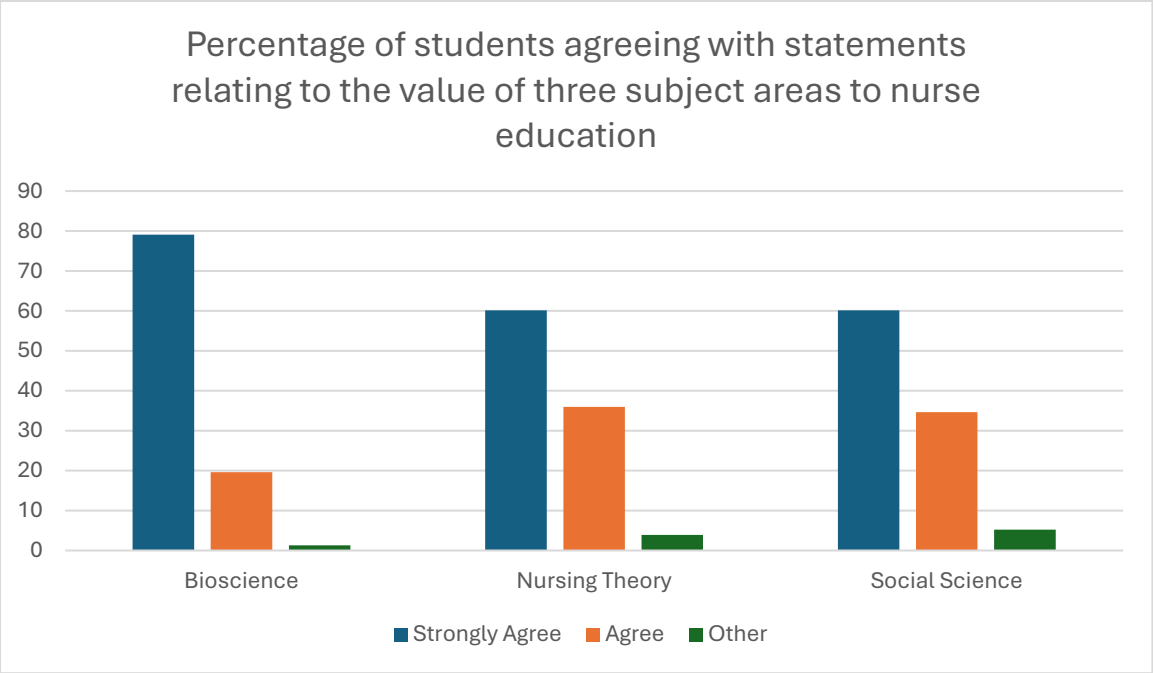


Graph 5.5 - Percentage of students agreeing with statements relating to the value of three subject areas to nurse education.

Therefore, in answer to sub-question D “Is bioscience still a valued part of nurse education for adult-field student nurses and how does this view compare with social science and nursing theory?” this data suggests that contemporary adult-field students do feel that the biosciences are a valued part of their education, and marginally more valued than social science and nursing theory.

Unsurprisingly, students had a positive view of all three subject areas in terms of their contribution to patient care. Almost all students agreed with statements that bioscience, social science, and nursing theory were fundamental to quality care with 98.69% strongly agreeing or agreeing that bioscience was important, 96.08% strongly agreeing or agreeing that nursing theory was important and 94.77% strongly agreeing or agreeing that social science was important. As with the previous question, there were noticeable differences with where students selected “strongly agree”, although the difference was not as large. Larger numbers of students

indicated that they strongly agreed that bioscience (79.08%) was important for patient care than nursing theory and social science (60.13% respectively), see graph 5.6.



Graph 5.6 - Percentage of students agreeing with statements relating to the value of three subject areas to nurse education.

Therefore, in answer to sub-question E “Do adult-field student nurses still regard bioscience knowledge as a determinant of effective nursing care and how does this view compare with social science and nursing theory?” this data suggests that contemporary adult-field students do regard the biosciences as important for patient care. However, whether they feel that bioscience is more integral or essential as social science and nursing theory has not been proven.

5.1.3 Research question 1 revisited.

In seeking to answer research question 1 “To what extent do the biosciences remain a cause for concern among contemporary adult-field students completing a

BSc (Hons) Nursing programme?" The quantitative data collected in the questionnaire highlights that:

- Three key elements of the "bioscience problem", namely anxiety, complexity, and classroom time, are issues of concern for contemporary students.
- Bioscience is more likely to cause anxiety in adult-field nursing students than social sciences and nursing theory, albeit with a smaller margin than anticipated (sub-question A).
- Bioscience is perceived by adult-field nursing students to be more complex and intricate than social science and nursing theory (sub-question B).
- Adult-field nursing students believe that more time should be dedicated to bioscience rather than social sciences and nursing theory (sub-question C).
- Adult-field nursing students clearly value all three topic areas and see them as integral to their education and their practice. However, the bias towards "strongly agree" responses for bioscience indicates that bioscience is the most valued of all three topic areas in terms of their education and the knowledge that informs patient care (sub-questions D and E).

5.2 Answering research question 2.

This section describes the data generated by the focus groups that took place on 10th, 25th of May, and the 19th, and 22nd of October 2018. It argues that the

generated qualitative data produced six key themes that describe the students' lived experiences and answer research question 2:

2) What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?

This section also describes the focus groups and their participants and acknowledges variances, anomalies, and group idiosyncrasies to provide context and ensure authenticity and promote fidelity in the findings.

5.2.1 The focus groups.

The four focus groups took place on the 10th, 25th of May, and the 19th, and 22nd of October 2018 and lasted between 40.42 and 51.53 minutes. Tables 15.15 – 15.18 provide details of each group. The allocated numbers identify the individual students throughout the remainder of this thesis. Only 4 of the participants were male, but this equates to 17.4% of the sample, which is slightly higher than the national average for UK nursing cohorts. The average age of a participant was 28.8 years, which corresponds to the mean age for a BSc student nurse (29.4) for that year's final year cohort, and 65.21% (15) of the participants self-identified as BAME, which, as argued earlier is close to the university average.

Focus Group 1 10th May 2018 Length: 42 minutes; 49 seconds		
	Gender	Age
Student 1	Male	36

Student 2	Male	37
Student 3	Female	22
Student 4	Female	44

Table 5.15 – Focus Group 1.

Focus Group 2 25th May 2018 Length: 44 minutes; 32 seconds		
	Gender	Age
Student 5	Female	21
Student 6	Female	34
Student 7	Female	41
Student 8	Female	20
Student 9	Male	35
Student 10	Male	24

Table 15.16 - Focus group 2.

Focus Group 3 19th October 2018 Length: 40 minutes; 42 seconds		
	Gender	Age
Student 11	Female	21
Student 12	Female	20
Student 13	Female	22
Student 14	Female	21

Student 15	Female	21

Table 15.17 - Focus group 3.

Focus Group 4 22nd October 2018 Length: 51 minutes; 53 seconds		
	Gender	Age
Student 16	Female	21
Student 17	Female	43
Student 18	Female	21
Student 19	Female	24
Student 20	Female	33
Student 21	Female	32
Student 22	Female	37
Student 23	Female	25

Table 15.18 – Focus Group 4.

As addressed in Chapter 4 each focus group was unsupervised and while this ran the risk of achieving little, with the potential for awkward silences and little engagement, all four groups saw full participation and a wealth of data was generated. The process was, however, not without its glitches and anomalies and this section summarises the problems encountered.

Each focus group was unique and approached their discussion differently. All participants were volunteers and, therefore, the focus groups were assembled conveniently, based on which students arrived on the advertised day. The result of this approach was a wide range of participants, not only in terms of age and

background but also in the number of participants per focus group. Group 1, for instance, was small, with just four participants, whereas eight students took part in fourth and final one. Each focus group had its distinctive characteristics or peculiarities, which ensured that four different perspectives were observed, and although common themes were apparent in all four transcripts, different perspectives provided an interesting overview of a cohort of individuals.

Fifty percent of group 1 were male and 75% were mature students, with extensive pre-nursing life experiences. This influenced their discussion, which was analytical and considered in comparison to the other groups. The students in group one were methodical in their approach and discussed concepts such as scientific objectivity and the perceived nebulous nature of social sciences. While there was humour, their approach to the focus group was akin to an intellectual exercise and was more resonant of an assessed piece of work rather than a casual conversation between peers. There was also a degree of enthusiasm in their discussion, suggesting that bioscience was, for them, a topic of interest and something they had all previously considered and discussed. It is interesting to note that this small group of students inadvertently consisted of four very capable students, two of whom went on to complete with 1st class degrees and all of whom were known to staff for volunteering, fully contributing to classes, and being student ambassadors.

Group 2 in contrast was more jovial in its approach. The transcript is littered with jokes and laughter and there was a sense of camaraderie and kinship. Their approach was rather immature in comparison to group 1 with no hint of intellectualism. Nevertheless, their discussion was frank and honest and betrayed concern about their lack of knowledge and understanding, and while they used humour to express their worries, the context of the discussion was highly relevant.

This group of students enjoyed taking part in the research and clearly enjoyed working with each other that day, leaving me to conclude that, like group 1, the biosciences are a topic of interest that they had previously discussed with peers.

Like group 1, group 3 engaged in a much quieter discussion, with less humour and more serious and intense discussion on their concerns. Their conversations highlight a mature and credible appreciation of the realities of nursing and working in contemporary healthcare settings. The dialogue highlighted some acute observations of recognised challenges nurses face and their role in not only addressing challenges but also in counteracting them. What is most striking is that the average age of the students in group 3 was just twenty-one.

The final focus group, group 4, proved to be the least fruitful in terms of useful data. The largest group, with eight participants, was rather pre-occupied with trials and tribulations of student life that were unrelated to the biosciences. Much of this discussion took the form of generic gripes about academic assessments and university life, which were interesting but not peculiar to biosciences and therefore deemed disinteresting. It is noteworthy that one of the students had a representative role and inadvertently hijacked the focus group to pitch their helpfulness and encouraged students to discuss their individual issues at the expense of a discourse on the stimulus, to the extent that one participant reminded everyone that this focus group was not the most suitable forum for this kind of discussion and that they ought to return to the subject in hand. This was not a malicious attempt to disrupt the focus group, rather a reflection of an individual student's good nature and a pitfall of unfacilitated focus group discussion. With no one to police discussion and students free to discuss whatever is important to them, inappropriate or immaterial discussion is inevitable.

On closer inspection, it was clear that there was a different subtext for each unique focus group. As Pope & Mays (2020) highlight, the direction of discussion is unique to each focus groups and will be determined by collective views. Pope & Mays (2020) further add that these nuances should be considered when analysing the data. Furthermore, the group characteristics provide further evidence of multiple perspectives that reinforce the notion that students consider the biosciences to be complex, anxiety-inducing, and inadequately covered in the curriculum, which corresponds with many of the concerns highlighted in the literature (see Chapter 2). Group 1's scientific and methodical approach was akin to a colleague assuming the role of a critical friend. They tended to highlight what they considered to be flaws or drawbacks in curricula and nursing practice with a degree of understanding. Whereas, group 2, approached their discussion with a degree of incredulity, intimating that their course was unsound and that the perceived lack of bioscience in their course was, in their view, ridiculous and unreasonable, a phenomenon reflected in the findings of Morrell-Scott (2019), in which nursing students were scathing about their curriculum describing deficiencies on bioscience as "nonsense" and "pointless". Incredulity was also apparent in groups 3 and 4's discussions, but rather than humour, group 3 discussed their concerns with a sense of anger and bitterness and produced a conversation that suggests they felt let down and maltreated. Group 4, while less bitter, did nonetheless give an impression of a group of individuals that felt hard done by and let down by the curriculum.

Criticisms of focus groups are concerned with the potential for individuals to dominate conversations, often at the expense of quieter or circumspect individuals, or the danger of clashes of personality or philosophy with the risk of arguments or disputes (Carey & Asbury, 2012). Furthermore, there always remains a danger of

simultaneous talking resulting in lost data or, conversely, rigid, or stifled conversations in which it is clear participants are not listening to each other and, as a result, rather than a conversation the dialogue merely consists of a series of unconnected statements (Wilkinson, 2004). There was also an assumption that all the volunteering students would know one another. However, as the focus groups were organised, it was clear that this was not the case. In many instances, groups contained individuals that had not previously met or engaged with other group members. Given their relative unfamiliarity, the common criticisms of focus groups were, therefore, more likely. However, despite the lack of previous encounters or friendships, many of these pitfalls did not materialise.

Overtalking and lost data due to simultaneous discussion did occur but it was not disruptive or burdensome. In many cases, clashes of voices occurred because of an enthusiasm for their discussion and were reflective of their passion for their concerns. There were no arguments or serious disagreements rather there was consensus, harmony, and a shared sense of discomfort, maltreatment, and irritation. The students spoke to one another with respect and courtesy, and while some individuals did dominate discussions all students were allowed to contribute and ensure their view was considered and heard. In only one group was dominance a significant factor. Two students tended to govern the conversation in focus group 3, with one of the five students contributing little. However, one of those students, student eleven, provided compelling and highly relevant comments on the impact of bioscience and on their clinical experiences.

5.2.2 Data analysis.

As highlighted in Chapter 4, a six-step process as described by Braun & Clarke (2006) was used to analyse the focus group data. This approach includes the following six steps:

- Familiarising oneself with the data,
- Generating initial codes,
- Searching for themes,
- Reviewing themes,
- Defining and naming themes,
- Producing the report.

The report produced in the final part of the process forms the basis of Chapter 6. Details of the first five steps of the process are included in this section.

As highlighted in Chapter 4 each focus group was recorded and saved as a sound file. Each sound file was listened to as soon as possible after the event. The purpose of this was twofold. Firstly, to begin the immersion into the data and secondly to become familiar with all the voices on the recording. Using a convenience sample allowed easy identification of the participants, which facilitated analysis of what were at times rather congested conversations. Once all four focus groups were completed and prior to transcription, all four were played twice in their entirety and then once with intermittent pauses when extensive notes were made.

The first focus group held on 10th May 2018 was transcribed personally. As Braun & Clarke (2006) recommend, doing so encourages deeper analysis and immersion into the data. While this was useful in that it did facilitate immersion it

was also time-consuming, taking 5 working days to complete. The remaining three focus groups were subsequently transcribed professionally. Once transcribed, all four focus groups were read and simultaneously listened to several times. Again, this was to facilitate immersion into the data and to correct the professionally transcribed texts which did not always identify the students correctly. During this phase, the professionally annotated transcripts were edited so each speaker was clearly and anonymously identified and that the pauses and other utterances such as coughs, filler words (i.e., um and ah), and laughter were included to provide a truer verbatim account of the conversations. Incorrect spelling of medical terminology, made by the professional transcribers, were corrected (Friese, 2022). The following are examples of these amendments:

In focus group 3, all the students laughed at student 9's comment that the university failed them. Adding the laughter to the transcript, accentuated the humour behind the point and ensuring the correct context behind the comment.

Professional transcription:

V5: "*That's because of, like, your placement not what you've learned here.*"

V3: "*Yes. Uni failed me. That's a really good point.*"

V5: "'*Cause if you're just looking at an assignment deadline when I go well I'd better cop on and do something today.*"

Amended transcription:

Student 12: "*That's because of, like, your placement not what you've learned here.*"

Student 9: "*Yes. Uni failed me. That's a really good point. [Laughter]*"

Student 10: "'*Cause if you're just looking at an assignment deadline when I go well I'd better cop on and do something today."*

Braun & Clarke (2006) refer to the "generating initial codes" step as the most basic element of analysis, in which broad ideas and themes are identified. Braun & Clarke (2006) advise identifying areas that are interesting to the researcher and giving each passage of interest a basic code. While arguably a rudimentary process, it proved to be a valuable exercise in that it enabled the identification and organisation of data into meaningful groups (Miles & Huberman, 1994). Below is an extract from focus group 1, which illustrates the method employed.

Focus Group 1:

Student 1: "*in practice and I think sometimes it feels like there is a disconnect, between what you're told at university and what you do in, in practice. (pause) To a certain degree."*

During the generating codes phase of data analysis, passages of interest were underlined. Each underlined segment was assigned a general theme, which in this instance was "theory-practice divide" as the quote suggests that students feel that taught theory does not match the reality of clinical practice.

The third step prescribed by Braun & Clarke (2006) involves the identification of specific themes. The process involved revisiting all the generated themes and considering commonalities and identifying relationships between them. In the following section, for instance (also from focus group 1), a student suggests what learning is required to be successful in theory assessments does not often match what the student feels they need to care for someone in placement.

Student 4: "*Yeah, y'know it's just that making sure that here is relevant to practice as well, like you say, isn't it, all working together.."*

This section was underlined and identified as a perceived assessment flaw. During the third phase of analysis, however, this idea was matched with “theory-practice divide” as an example of “disparity.” The notion here is that students feel there is too much disparity between the reality of nursing practice and their university experience of learning the biosciences. Disparity was subsequently identified as significant and of interest.

In step four of the analysis process, as per Braun and Clarke’s (2006) advice, all four focus groups and the data were reviewed via two distinct processes. Firstly, each theme was revisited. Each coded extract was re-read and examined. Only if a coherent pattern formed was a distinct theme identified and coded. This involved collating related groups into broad themes, which contained sub-themes that were subsequently numbered. For example, “disparity,” highlighted earlier, became a theme that consisted of four sub-themes:

Disparity1 – Classroom versus practice: What is taught in the classroom does not marry with what happens in practice.

Disparity2 – Assessment versus practice: What students are assessed on in the University does not reflect what they feel they need to know in practice.

Disparity3 – Disparity between academia and reality of practice: Students feel that academia, by which they mean research and criticality, does not influence, or reflect the reality of working as a staff nurse.

Disparity4 – Disparity between skills/practical in practice and bioscience knowledge: Students feel that the bioscience content of the curriculum does not inform the skills they execute in practice.

The second process of the reviewing themes phase of analysis includes

reviewing the themes in relation to the complete data set, which in this case was all four focus group transcripts. This level of analysis is triangulation (Moule & Hek, 2011), and a further quality control measure that can ensure trustworthiness as it can overcome some of the intrinsic biases of single-observer studies and capture a contextualized picture of the student perspective (Polit & Beck, 2014). After revisiting the whole data set and reviewing and refining themes, thirty-four were identified as significant and of interest (see appendix 5).

The penultimate phase of the data analysis process, as guided by Braun & Clarke (2006) is referred to as defining and naming themes. This involved the distillation of the identified thirty-four themes into a smaller refined set, which will enhance analysis and ensure coherence. After completion of this phase of the analysis, all thirty-four themes were organised into six distinct concepts or constructs, all of which describe the student nurse's experience of learning bioscience from a distinct perspective. These six concepts are:

Concept 1: *Indispensability* – the truism that an understanding of the biosciences is a prerequisite for safe and effective nursing care.

Concept 2: *Deficiency* – the perception that the provision of bioscience in the curriculum is deficient in that it does not meet their expectations.

Concept 3: *Burden* - the perception that learning the biosciences is burdensome and arduous, and that the amount of knowledge required is insurmountable.

Concept 4: *Angst* – the belief that learning and using bioscience causes anxiety and stress.

Concept 5: *Reality* - the notion that learning bioscience in the reality of clinical practice is problematic and can adversely affect their understanding.

Concept 6: *Identity* – students assume different identities depending on their situation. These assumed identities impact on their learning of the biosciences.

5.2.3 Concept 1: Indispensability.

Indispensability – the truism that an understanding of the bioscience is a prerequisite for safe and effective nursing care.

Throughout all four focus groups the participants promoted the biosciences above all other aspects of their learning. The following excerpt from focus group 2 encapsulates this perspective:

Student 10: *"I do think biology, the bioscience side of the course is probably the most important module*."

Student 6: "*Oh yeah definitely. And I think it's so interesting*."

Student 8: "*It's not prioritised enough. Yeah. It's not prioritised enough and it is the most important."*

Furthermore, there was an audible passion for the biosciences expressed in each discussion. Many students claim that they find bioscience interesting, stimulating, and rewarding, especially in comparison to other aspects of the curriculum (namely, research and evidence). Getting to grips with bioscience is considered exciting. The idea that learning how the human body works and how students can utilise that knowledge to have influence is something that they enjoy. There is a sense that learning bioscience is rewarding, in that it has a distinct purpose, which from the student's perspective is noble, in that it aims to preserve life. Passion for a particular specialism also provides a stimulus for learning. Students express a keen interest in physiology that informs an area of interest, in

which they can envisage working in the future.

"Yeah, I sort of feel the same as well, cos this is something that we, in the future we will have to think about anyway. So, really I would rather learn something like this [referring to the focus group stimulus] *and have that understanding of how actually it implies to what we are going to do as nurses in the future."* – Student 3, focus group 1.

Further analysis of the focus group dialogue highlights another related shared belief, which suggests that, from a student perspective, there is a clear demarcation between bioscience and other aspects of their learning. This is counter to the philosophy of holistic nursing care, which dictates that optimal care can only occur when the nurse accounts for not only an individual's pathophysiology but also their social and psychological status (Frisch & Rabinowitsch, 2019). Despite contradicting this overriding nursing philosophy, the notion that the curriculum is divisible into two distinct camps is illuminating. It suggests that students value the biosciences as being integral to their work and their identity. Nursing care is contingent on an understanding of how the human body works and reacts to disease and pharmacology. This knowledge is fundamental, and nursing does not occur without it. Whereas, other topics, especially those that explore the evidence base of our care, are adjuncts or peripheral subjects that can enhance their nursing practice but are not in themselves essential. In the following comment the student compares bioscience with other aspects of the course, which they colloquially refer to as "the academic side of nursing," by which they mean research as well as social aspects of care.

"*Yeah there's just too much emphasis for me personally and just too much emphasis on the academic side of nursing…..Bioscience is interesting but this microbiology, pharmacology, we haven't barely touched anything in regards to that.*" – Student 6, focus group 2.

"....I feel like biosciences should be considered more of a priority.....especially some of the topics y'know if you read like this thing, like anatomy, physiology, patho, microbiology and pharmacology and that thing we had sort of had that you know.." – Student 3, focus group 1.

The idea that a direct link exists between understanding how the human body works, and effective nursing care was endemic in the dialogue of all four focus groups. From the students' perspective care is founded on the understanding of bioscience because without a reasonable comprehension of physiology and pathophysiology, nursing care will be deficient. Therefore, the need for biosciences to be part of the curriculum, from the student's perspective, is self-evident, especially when compared with other elements of the curriculum. In the following exchange in focus group 2, the students discuss how bioscience aided their clinical practice while the applicability of other academic work was not clear.

Student 8: *"But have you ever been, yeah have you ever on placement and look thought back to , I, oh let me just think about* [year three research module]*, like that that's going to help me.*"

Student 7: *"No!"*

Student 8: "*... you just think health promotion. It's not really but I've always thought back to our bio modules and that helps me, like sepsis last year."*

Student 6: *"One hundred percent. Especially if you're working in like particular erm departments or like CCU* [Coronary Care Unit]*."*

The results from the quantitative phase of the study add weight to this assertion. While students clearly value bioscience, nursing theory, and social science and see them as integral to their education and their practice the bias

towards “strongly agree” responses for bioscience indicates that bioscience is the most valued of all three topic areas in terms of their education and in terms of knowledge that informs patient care. Furthermore, these findings also correspond with research by Jordan et al. (1999), Clancy et al. (2000), Friedal & Treagust (2005), Fell et al. (2016), Barton et al. (2021), all of which found that students valued and favoured the biosciences and felt they enhanced their nursing practice (see Chapter 2). This unequivocal viewpoint should be expected because, as highlighted earlier, nurses are concerned with holism and holism cannot occur if the biological aspects of a patient’s situation are disregarded. As Trnobranski (1993) and Wynne et al. (1997) highlight every individual a nurse encounters should be viewed from a unique perspective and through a biological as well as a sociological lens. The focus group discussions indicate that, from a student perspective, achieving this ideal can only occur if the nurse understands the biosciences. This view corresponds with those academics who argue that inferior quality bioscience education is associated with incomplete holism and poor care outcomes (Clarke, 1995; Jordan et al., 1999; Friedel & Treagust, 2005; Davis, 2010).

“Yes. And even in that case, it’s from one extreme to the next. First year, it should be all anatomy and physiology. I think you should really know the body. And then you start thinking about the holistic side of care. And then you go to the acutely side of care for your third year. I think that’s where they’re [tutors] *kind of missing out .” –* Student 11, focus group 3.

5.2.4 Concept 2: Deficiency.

Deficiency – the perception that the provision of bioscience in the curriculum is deficient in that it does not meet their expectations.

There is a general sense throughout all the focus groups that students are not confident that they know enough about the human body to practice effectively as a staff nurse. Furthermore, they lay the blame for this quite firmly on the curriculum, which they feel is deficient in bioscience. The focus group transcripts are littered with examples of exasperation at what they view as a paucity of bioscience throughout their course thus far. Below are two examples of typical brief exchanges that highlight this view:

Focus group 1:

Student 4: *"I think, I think, this whole course, I think more focus should be on the patho* [pathophysiology] *side."*

Student 3: *"Biology yeah, side of things, y'know 'cause that's what you are going to do in the* [pause] *research is important, yeah."*

Student 4: *"Yeah, it's surprising how little there was actually."*

Focus Group 2:

Student 7: *"...Oh dear. So, we need more practical..."*

Student 8: *"Practical and more..."*

Student 5: *"Bioscience……Actual bioscience."*

Student 6: *".....we need a bit more microbiology I think."*

Student 10: *"Definitely more pharmacology."*

There are many bioscientific areas that students feel were not addressed in enough depth during their degree. Popular omissions include pharmacology, microbiology, gynaecology, the renal system, the musculoskeletal system, gunshot and stab wounds, and the physiology of death. There is a sense of fear among the students that not understanding these biological subjects would be detrimental to their careers and that it was ineffectual curriculum design that was at fault, as the following exchange from focus group 3 regarding the renal system indicates:

Student 14: "*...once you're qualified* [pause] *you really should have the basics behind you from uni. Like, you need to know about renal and respiratory and all the basic things."*

Student 11: *"If you gave me a renal patient now, I, I would not know what to do with them. I, I know nothing about renal."*

The perspective is related to bioscience problem premise 7, which states that nursing students expect there to be and would like there to be, more classroom time dedicated to bioscience (Jordan et al.,1999; Davies, 2010; Taylor et al., 2015; Craft et al., 2016; Mhlongo & Masango, 2020). This premise is also reflected in the results of the quantitative phase of this study (see 5.1.2) in which 77.12% of students ranked bioscience above social science and nursing theory in terms of need for more classroom time.

5.2.5 Concept 3: Burden.

Burden - the perception that learning the biosciences is burdensome and arduous, and that the amount of knowledge required is insurmountable.

The students' conversations present an interesting conundrum, which appears unsolvable. As already established, the students place a high value on

bioscience and its usefulness in care provision. The students also felt that greater autonomy and confidence would come with higher levels of bioscience knowledge. When analysing their conversations, it is also clear that the students feel that not only is bioscience valuable it is also a subject area they enjoy. However, despite their affection for the biosciences, for many students, their learning of the biosciences in classroom settings presents a significant challenge. Focus group discussions highlight a plethora of potential barriers and challenges that need to be overcome to master the biosciences. The most cited barriers or hurdles are perceived complexity, procrastination, futility, indecipherable nomenclature, and the insurmountable volume of information. As the following discussion highlights students feel the sheer volume of learning is overwhelming. To place their anxieties in context, when student 8 refers to "all the systems", they are referring to the body systems taught in the first year, which at the time included the cardiovascular system, the respiratory system, the renal system, the nervous system, the endocrine system, the integumentary system, the immune system, the musculoskeletal system as well as genetics.

Student 6: "*I think thinking back to erm bio basis* [The Biological Basis of Health and Wellbeing – 1st-year module] *in first year, I just, when we first started, we had so much to do like erm cardiovascular, renal. I found it very overwhelming because there's just a lot to do, there's a lot of information erm, you need to know so much in such a short period, but it's quite relevant and important, important. But I just found first-year biological basis was just quite overwhelming."*

Student 8: "*Yeah, all of the systems..."*

Student 6: "*Which is a lot. Every week you had a new system with so much information to know about, anatomy of the body and how the kidneys work."*

Student 8: "*Yeah. It's difficult.*"

Student 7: "*Do find that if it's…… if for me personally, I always panic as soon as I get the, the question or whatever. I to do, I panic, and, in my panic, I tend to put the work away!*"

The data also suggests that burden of a perceived insurmountable volume of information is exacerbated by infrastructure and their educational environment. For example, there are challenges associated with classrooms, assessment methods, and inefficient teaching and ineffective tutors.

5.2.6 Concept 4: Angst.

Angst – the belief that learning and using bioscience causes anxiety and stress.

As already established, students value and desire bioscience knowledge. However, the pursuit of bioscience knowledge comes at a cost in terms of mental wellbeing and anxiety. While students claimed in the quantitative data that bioscience was more likely to cause anxiety than other subject areas, the students in the focus groups did not state explicitly that bioscience caused them anxiety. Indeed, through the four focus groups there was no reference to feeling anxious and only one reference to anxiety, which occurred in focus group 4 and then only a general expression to describe an individual's personality trait. However, when analysing their conversations there were clear incidences that strongly suggest that students are anxious about the study of bioscience and their perceived lack of knowledge. In terms of angst therefore, the data from this focus group suggests that anxiety, for this group students, manifests as anxiety caused by the learning of bioscience and anxiety caused by their perceived lack of knowledge. The main expression of anxiety related to learning connects to their perceptions of self-directed

learning or “being left to it,” whereas their anxieties relating to their perceived lack of knowledge are discussed in terms of knowing or more accurately not knowing enough. Phrases such as “I should know this,” or “I need to know this,” are present in this data as is the ethos that they are all ill-prepared for qualification in terms of bioscience knowledge. The following exchange from focus group 3 is one of several that discusses their future responsibilities and provides an example of their angst.

Student 15: “*Because, realistically, we’re, like, in our third year now. What system do we know really, really well?”*

Student 13: “*None of it.”*

Student 11: “*Respiratory a little bit.”*

Student 14: “*And then asthma.”*

Student 15: “*But that’s so scary ‘cause, like, literally, in less than a year, we’re going to be out there and we... people are going to be looking at us, people are going to be looking at us, can you show us you know about that?”*

Student 11: “*You should know that. Your students will be...”*

Student 13: “*And you know what they say? They say the newly qualified are ones, are the fresh ones with knowledge and you’re just going, what? I’m not knowledgeable.”*

5.2.7 Concept 5: Reality.

Reality - the notion that learning bioscience in the reality of clinical practice is problematic and can adversely affect their understanding.

Analysis of the data reveals an acute insight into the student perspective on their learning experiences whilst collaborating with qualified staff. Given that student

nurses spend around 2300 hours in practice during their degree (NMC, 2023a), it is little wonder that experiences of working in practice settings alongside qualified nurses dominate the focus group discussions. The students in all the focus groups viewed practice and theory as two distinct and separate entities, rather than as conjoined elements that inform one another. While tutors consider taught content to be an adjunct that complements and reinforces practice learning, from a student perspective, rather than viewing theory and practice as being in a symbiotic relationship, their opinion is that they are barely related. The students discuss practice learning as being authentic, as opposed to classroom-based learning, which in comparison to placement is viewed as false, fake, or fantasy. As a result, classroom-based learning lacks credibility and therefore has a lower impact on their learning. However, while viewed as a panacea, their experiences of learning bioscience in practice consistently disappoint the students. Rather than being an ideal location for learning, clinical practice is described as a chaotic and often shambolic arena that is unconducive to learning. Such impressions of disorder are exacerbated by inadequate relationships with their clinical colleagues or by cultures which are interpreted by the students as anti-bioscience, as the following quote illustrates.

"But I feel like that like mentality is everywhere. So, like I've been on placements where my mentors would be like, 'what are your aims for this placement?' And then they would just like make a face or kind of like ignore the one where you say like relate the pathophysiology to the patients. And they'll be like, 'oh, how about learning how to like manage this' and 'do your S-bar' or like 'practice doing the policies.' And I was like, 'yeah, fair enough they're all important but so is this.' Like, if I can't understand my patient's condition, what is the point of like anything?" – Student 8, focus group 2.

5.2.8 Concept 6: Identity.

Identity – students assume different identities depending on their situation. These assumed identities impact on their learning of the biosciences.

Throughout all four focus groups discussion often highlighted that how students self-identify in the context of learner in clinical practice influences their approach to learning the biosciences. Furthermore, how they would like to be perceived by others also provides a strong motivator for learning. The students cite excellent nursing role models who demonstrate a proficient level of knowledge as well as a desire to be like other allied health professionals, who they associate with possessing higher levels of bioscientific knowledge, such as doctors or physiotherapists. As one might expect, assessment is another powerful motivator and the students in these focus groups were no exception, expressing a desire to know and understand the biosciences so that they could not only pass their academic assignments but also demonstrate competence and achieve their clinical skills, which is an essential component of their practice assessment and essentially the gateway to qualification (NMC 2023c). A more sinister motivation is the fear of making mistakes. Students feel the burden of their responsibility and they appreciate that mistakes can cost lives. Knowledge of bioscience is associated with the elimination of mistakes and therefore provides a potent motivator for more learning. As a result, students self-identify as being flawed or inadequate. In this passage, student 11, highlights the need to be an efficient carer but simultaneously identify as inefficient and a lack of bioscience is to blame.

"I need to know what's going to be expected of me when I go and practise and what I need to know right now. And what knowledge is going to keep me and the patients safe?……. You're not giving me the knowledge I now need to go out." – Student 11, focus group 3.

Students also identify as caring individuals, and they are also motivated by the desire to do what is best for the people in their care. There seems to be an innate desire to ensure patients receive quality care. While this is not defined, the assumption is that quality care can only exist in the presence of a solid foundation in bioscience, which is contemporary and up to date. This view is reinforced with an aspiration to continually seek to improve and enhance practice, and that for nurses to be able to develop and improve care, they need to be conversant in the biosciences. As highlighted previously, this view remains a constant recent nurse education literature and research. This view corresponds academics who argue that inferior quality bioscience education is associated with incomplete holism and poor care outcomes (Clark, 1995; Jordan et al., 1999; Friedel & Treagust, 2005; Davis, 2010, Montayre et al., 2021).

Further analysis of the dialogue from all four focus groups indicate that students also assume other identities while in clinical practice. These identities are dependent on the student's situation or the context of their learning. For example, the students often self-identify as a visitor or traveler on a journey of discovery. This is particularly true of their placement experiences where they move from area to area, not getting to know staff or the practice area, which they feel impedes their learning not just of bioscience but all aspects of nursing care. Students while caring individuals also demonstrate a desire to be identified as professionals and serious individuals. They also identify as inferior to others and express themselves with a sense of shame. Furthermore, the subtext of much of their discussion suggests they consider themselves to be victims of perceived injustices, all of which impede their learning.

5.3 Conclusions.

The use of a pilot study enabled the formulation of a questionnaire more suited to answering research question 1. The data generated clearly indicated that further data collection and analysis was warranted. The data collected through the quantitative phase of this project answers research question 1 and that for this group of students, while the biosciences are valued, the learning of them remained a concern in terms of anxiety, perceived complexity, and classroom time. This hypothesis is reinforced by the data gathered in the pilot student with its quantitative and qualitative data generating similar findings.

The generated qualitative data justified the use of unsupervised focus groups as, despite the potential pitfalls, a rich dataset was obtained, free from tutor interference. The data indicates six key themes that describe the students' lived experiences and careful analysis of them answered research question 2 in that the perspectives and experiences of modern nursing students are encapsulated in six concepts, which are indispensability, deficiency, burden, angst, reality, and identity. The next chapter will analyse the finding that bioscience remains a concern for modern nursing students. It will also analyse how the six concepts that describe their experiences relate to the literature and what the implications are for nurse education, in terms of pedagogy and clinical learning. It will argue that these six concepts present nurse tutors with two paradoxes or tensions, that impact on the students' ability to learn and ultimately use the bioscience to enhance patient care.

Chapter 6

Discussion: The perspectives and experiences of adult-field student nurses learning bioscience

This chapter analyses the research findings described in Chapter 5. It will argue that the data generated in the quantitative and qualitative phases of the study present two tensions or paradoxes that place a burden on student learning. Firstly, this chapter will argue that there is a tension between the value students place on the biosciences and the discomfort they describe when learning them, a “value and discomfort” paradox. This paradox describes the relationship between the students’ desire to learn the biosciences and their classroom and self-directed learning experiences. Secondly, another tension exits between the value students place on the biosciences and their struggles to learn them while working alongside qualified nurses, a “value and reality of nursing practice” paradox. This paradox describes the relationship between the desire to learn bioscience in practice while simultaneously coping with the reality of working in front-line health services. Both identified paradoxes are predicated on the notion that students value the biosciences and feel they are integral to their survival as a qualified nurse, a notion expressed by the students in the focus groups (concept 1 – indispensability) and in the questionnaire. This chapter will argue that both paradoxes impact negatively on the students’ ability to learn the biosciences and that if nurse education is to be enhanced researchers need to focus on pedagogical changes that can successfully reduce the tensions between the value of bioscience, its burden on learning, and ineffective education in practice.

6.1 Indispensability: Bioscience is vital.

Throughout all four focus group discussions the idea that bioscience was valuable and vital was a constant. This indicates that for this group of adult-field students the value of bioscience is not just a simple belief or conviction. It is an accepted indisputable truth. This accepted truism is more compelling given that the students were not asked to discuss bioscience or their attitude towards it, rather they were asked to look at a proposed bioscience-based exercise and discuss how it made them feel. Therefore, stressing that bioscience as a fundamental necessity for safe and optimal nursing care was of the students' own volition and not influenced by the researcher. Student 11 in focus group 3 illustrates this:

"... What can be taught is anatomy and physiology. Understanding how I can save my patient. 'Cause, like, I've had a placement in cath lab, where that anatomy was going to save that patient. You had to know what chamber of the heart was going to do what. What medication you're giving for what reasoning because of what it does."

Quotes such as these demonstrate that for student nurses, bioscience provides the bedrock or foundation for their decisions. Not only is bioscience viewed as valuable it is also considered integral to their working life. This view is further reinforced by the quantitative data generated by the questionnaire. As discussed in Chapter 5 (graphs 5.5 and 5.6) the students in this study concluded that bioscience was valued and that it was perceived to be more valuable than social science and nursing theory in relation to professional practice and education.

This view correlates with findings of nurse education research spanning two decades (Thornton, 1997; Jordan et al., 1999; Clancy et al., 2000; Friedal & Treagust, 2005; Kyriacos, 2005; Fell et al., 2016). However, unlike the

aforementioned studies this evidence is more compelling as it is derived from unprompted, self-determined terms. As highlighted in Chapter 2, much of the research into the learning of bioscience is antiquated and/or conducted overseas. Of the studies that explore the value of bioscience only Fell et al. (2016) conducted their research within the last ten years and their data is survey based and therefore lacking in depth.

The students consider bioscience to be integral to the maintenance of life. Knowledge of the biosciences is synonymous with the detection of deterioration and avoidance of death, the implication being that a lack of bioscience knowledge places patients' lives in jeopardy. Students consider nursing to be a problem-solving process, one in which they assess, implement care interventions, and evaluate their effectiveness. According to this set of adult-field students, bioscience knowledge is the key to problem-solving and it can facilitate the selection of appropriate nursing interventions. Furthermore, for this group of students, bioscience knowledge is essential for the avoidance of death.

"I've had one mentor that was, like, I want you to know all the chambers of the heart. I need you to know what medication does this. I need you to know all this stuff. Because in coronary care, you'll kill someone. But that needs to be emphasised. If we don't know this stuff, no matter what department you go into, renal, oncology, anything, you could end up killing somebody by not having this knowledge." – Student 11, focus group 3.

Again, this perspective is reflected in nurse education literature and several UK studies have already demonstrated the view that bioscience enhances patient care and promotes safety. Interview data, for example, demonstrated a clear link between bioscience and clinical decisions in the eyes of staff nurses (Prowse and Heath, 2005) and earlier data highlighted that nurses value bioscience in terms of

general nursing decisions and pain management (Jordan, 1998; Jordan et al., 1999). Nevertheless, these studies are outdated, and this thesis provides contemporary evidence that modern students still value bioscience as much as their historical counterparts.

The students believe that bioscience knowledge enhances their confidence and enables them to articulate their decisions and provide better care. At times this is expressed negatively, in that they feel their lack of bioscientific knowledge results in a lack of confidence:

"*Exactly. And the knowledge that we're getting from here it's not enough to put us there to be, like, confident doing this 'cause I know this and I know that. But we don't know a lot about the, like, the science parts and we're just like, oh my God, like, how am I going to address this? And how am I going to talk about them dying? And how am I going to talk about heart attacks when I don't even know half the stuff that goes on in the body*" – Student 13, focus group 3.

The connection between bioscience and confidence has recently been illustrated by Andrew et al. (2015) and Montayre et al. (2021) who argue that bioscience knowledge enhances the nurse's ability to communicate their care decisions with confidence and conviction. The students also believe that bioscience knowledge allows them to negotiate challenges and consult with other healthcare professionals as equals. For the students in this study this is associated with the notion of empowerment, which they correlate with confidence. The students' idea of empowerment is, however, nebulous, but it is nonetheless a popular ideal, which is part of the student nurse lexicon and an important part of their psyche. Empowerment, from a student perspective, relates to their ability to function autonomously and make important decisions in the absence of other healthcare

professionals and is achievable through an enhanced understanding of the human body. The following quote illustrates this idea:

"I find doctors now discuss the prescription with you. When they write things out, they'll actually [say] *'do you think this is the best alternative?' And I think that's really good because you're thinking, you have to know if it's good for that patient. And that's better. We're getting that, like, line of communication better."* – Student 11, focus group 3.

Another interesting perspective was that this set of adult-field students considered bioscience essential because nursing itself is evolving as a profession. The suggestion is that the role of the nurse is expanding and extending and the way for students to respond to this evolution is to ensure they understand and appreciate the biosciences. The focus groups coincided with the publication of the NMC's most recent recommendations for pre-registration nursing programmes (NMC, 2018b), which advocates nurses qualifying with a more complex skillset. The students recognised that these changes were afoot and that those qualifying after them would do so, being able to execute skills not expected of newly qualified nurses at the time, such as intravenous cannulation or phlebotomy. The consensus was that they would need to be more bioscience savvy so they could remain up to date and as proficient as the nurses they will be mentoring in the future. As discussed in Chapter 2, there is recent evidence that reinforces the view that nurses require enhanced bioscience knowledge to cope with the expanding roles such as non-medical prescribing and Advanced Care Practitioner (ACP) (Gordon et al., 2017, Perkins, 2019). This group of students are reflecting the established view that they need the bioscience knowledge to make the necessary clinical decisions to improve the standard of care (Taylor et al., 2015; Wood et al., 2020; Montayre et al., 2021). Their concerns are that their current education does not fulfil this requirement, as the following quote

illustrates:

"I think, like, the nurse's role is changing completely. Like, there, there's not enough doctors so a nurse is expected to know this amount of stuff……. Because nurse practitioners, now, are taking over the junior doctor role. There's more nurse prescribers than there's ever been. And the nursing role is building bigger and bigger and bigger" – Student 11, focus group 3.

This quote also highlights non-medical prescribing as an example of the expanded nursing role that causes anxiety. The students were clearly referring to the ever-increasing use of nurses in the prescription of medication, a role that is increasingly common (Dunn & Pryor, 2023). Fears and anxieties concerning levels of pharmacological knowledge are long standing (see Chapter 2) with identified causes being that a lack of confidence (King, 2004; McIntosh et al., 2016) or a lack of curriculum time (Latimer et al., 2017; Khan and Hood, 2018). The findings of this thesis add weight to both theories as they confirm that contemporary students still lack confidence in their ability to prescribe or take on extended roles and identify their curriculum as the cause.

6.2 The "value and discomfort" paradox.

Given the high currency of bioscience among this student population has been established (Concept 1 – indispensability), this section will argue that three further concepts, concept 2 – Deficiency, concept 3 – Burden, and concept 4 – Angst, provide an opposing tension, which produces a value and discomfort paradox. These three concepts relate to students' relationship with the university, or more specifically with tutors and the classroom and their origins are rooted in

activities of learning, including classroom experiences, reading, and self-directed study. This section will argue via further analysis that these three concepts explain why a value and discomfort paradox exists.

6.2.1 Deficiency: The curriculum does not meet the students' expectations.

A recurring theme in all the transcripts is the perception that the curriculum simply does not meet the student's expectations. At times, the source of their dissatisfaction is vague, and they are ambiguous about what they feel is missing. Overall, however, there was a tangible sense of disappointment in the amount of bioscience instruction. The students felt the curriculum was lacking and described bioscience as only occurring in concentrated pockets as opposed to being spread evenly throughout the three years. As a result, some students feel that their knowledge and learning had been eroded by the spasmodic presence of bioscience in their timetable. Others felt that the timing of their clinical placements did not correspond with the theory taught immediately beforehand and that a more focused approach would have been advantageous. While learning assessment of acutely ill individuals, for example, a student may find themselves working in the community, and vice versa, a student may find themselves working in the emergency department after exploring long-term conditions in class. While all UK nursing courses are based on standards produced by the NMC, they are all unique. Therefore, all criticisms from the students are aimed firmly at their educational institution. Recent research, however, acknowledges that students are sensitive to the location of the biosciences in their curriculum (Barton et al., 2021), with both tutors and students accepting that bioscience should have a continuous presence, especially in their final year, as opposed to frontloading bioscience early in the course, something this group of

students were subjected to. This suggests that their criticisms may have merit and adds further weight to the notion that their curriculum is deficient in the biosciences.

While some of the criticisms of deficiency are ambiguous there was a notable explicit notion that there is a perceived bias against the biosciences. This concept is synonymous with a historic premise that a bias against bioscience in favour of social science exists in nurse education (Courtenay, 1991; Trnobranski, 1996; Clancy et al., 2000). As discussed in Chapter 2, this ethos is a tutor construct and not normally voiced by students. However, in this study the student perspective is distinct, and they articulate a bias against the biosciences and that social sciences, communication skills, research, and evidence-based care, are promoted at the expense of bioscience. The following quotes from different focus groups reinforce this perspective:

"I think that, I think that's the thing, that the programme sort of prioritises writing about the softer skills, so you know you are expected to write academic essays about communication and academic essays about being caring…….but actually I think there's, there should be much more focus on bio, much more focus on pharmacology" – Student 1, focus group 1.

"Like, with nursing students, do you not feel like we don't do enough bio and we concentrate so much on research and all these other things? And in practice, you really need to know the human body. So, we don't do a lot of anatomy" – *Student 21, focus group 4.*

The group discussions also demonstrated that, from a student perspective, there is a clear demarcation between bioscience and non-bioscience topics. Bioscience is objective and scientific. It is measurable and associated with numerical values that have merit and have currency with other healthcare professionals, especially doctors. This is in stark contrast to other subject areas,

which are deemed by students to be woolly, ambiguous or “simple common sense.” In clinical practice, biological values have a high currency. Blood pressure readings, respiratory rates, blood results, fluid balance measurements, and other biological markers measure stability and recovery, and all have a biological underpinning. They all, also, form part of a healthcare lexicon, which enables students to communicate with other professionals on an equal footing, a phenomenon also identified by Wilkes & Batts (1998), Clancy et al. (2000), Friedal & Treagust (2005), Molesworth & Lewitt (2015), and Craft et al. (2016). An understanding of words such as hypotension, dyspnoea, anaemia, and overload, for example, enables adult-field students to engage with other healthcare professionals. Furthermore, learning the bioscience lexicon gives them the confidence to contribute to patient care decisions. The students’ view is almost binary, in that bioscience is objective, and being objective and scientific is superior to non-bioscience topics, which are subjective and therefore of less value. This was evident in discussions around academic assessments and the value of non-scientific assessments.

“I like questions like this [reference to discussion stimulus]*, erm, because it’s.. there’s a clear answer. More or less. It’s sort of very much a fact-based thing isn’t it, y’know especially when you’re talking about physiology and pathophysiology. Very much, y’know, this is how the body works……and there’s not very many shades of grey…….*[Referring to non-scientific assessments] *we are expected to sort of y’know, talk, talk about things in an academically rigorous way……and to find stuff that that supports…y’know it just, quite often you get bogged down in very woolly things very quickly.”* – Student 1, focus group 1.

The subtext of this discussion and others like it suggests a dualistic perspective, in which bioscience is factual, and therefore is positive. Non-scientific subjects, however, are too woolly and nebulous and, therefore, are of less value.

Facts have credibility and are easier to learn. This contrasts with social science, for example, which is more conceptual and therefore less accessible. In terms of academic study, facts are easier to regurgitate and evaluate, whereas concepts are open to interpretation and debate and therefore, from the student's perspective have less worth. This viewpoint is counterintuitive to nursing academics who argue that dismissing the non-bioscience topics as being imprecise or an irrelevance would lead to inadequate care (McPherson, 2009; Koch et al., 2016).

Nevertheless, as demonstrated above the value of bioscience as an objective basis of nursing practice was an accepted opinion among these students. This could be explained by their experiences of learning non-scientific topics, which they consider impenetrable at times. As Edgley et al. (2009) found student nurses have described learning social science as unsettling and compared to bioscience difficult to learn. Edgley et al. (2009) argued that this is because their students viewed bioscience as fixed and uncontested principles as opposed to social science, which is more nuanced. Social science is based on the individual and their place in society, and therefore changeable and difficult to conceptualize. In the student's view, this contrasts with bioscience, which has a perceived systems-based framework. For instance, the heart and blood vessels function together as a body system, which operates predictably, and has a tangible application in that students record blood pressures and heart rates regularly to assess the cardiovascular stability of their patients. From the students' perspective, this is easier to appreciate and understand than social theories or research methodology, which is much harder to apply to practice. Given that engaging nurses in conversations about evidence-based healthcare is considered difficult and that research is often seen by nurses as something that doctors do (Cetroni, 2024), it is conceivable that research and

evidence would not be a regular topic of discussion with qualified nurses. Whereas the importance of maintaining physiological assessments will dominate discussions between students and qualified staff daily.

In their discussions, students tended to compare bioscience to aspects that characterise nursing and yet remain difficult to define or encapsulate. Two such concepts, raised on several occasions, are compassion and care, both of which caused animosity at times. While both terms are synonymous with the nursing profession and populate literature and guidance from the NMC (NMC, 2018a), they are open to interpretation (Kitson et al., 2010; Younas and Maddigan, 2019), which may explain the debate within the focus groups. Interestingly, concepts such as care and compassion are not taught as discrete theoretical concepts, they are principles that underpin course content and classroom discussion (NMC, 2018b). They also influence concepts of professional behaviour and are familiar assessment terms in practice (Roxburgh et al., 2018). While they are not taught as discrete theories, for this group of students they remain a visible and tangible aspect of the course, to the extent that they feel too much time is dedicated to them, again at the expense of the biosciences.

Some students felt that compassion is just one element of nursing practice and that what is required is a grounding in bioscience theory. While compassion is commendable, the students felt that they are not merely angels, they are serious professionals, who require scientific knowledge to practice effectively. Furthermore, some students felt that compassion cannot be taught. It is something that some people possess and the more compassion you possess the more likely you are to venture into nursing. Bioscience, on the other hand, is tangible knowledge that can only be acquired through teaching and learning. Spending time teaching concepts

such as compassion, therefore, is a distraction from the main objective, which is to ensure they learn as much anatomy and physiology as possible. This perspective is suggested in the exchange below from focus group 3.

Student 12: *"You, you understand a little bit of everything, whereas here, we're just being sugar-coated with, oh, compassion, care. How can I be compassionate if I don't know my job? How can you be compassionate if you have to go home and write an* [essay on interprofessional relationships] *and not dedicating yourself to, um, about, um, researching on, you know, new treatments for..."*

Student 15: *"Like, certain knowledge".*

Student 14: *"Things we actually need to know".*

Student 11: *"I think they need to realise compassion can't be taught. It can't be taught. It's either in you or it's not. You can't sit and do a lecture about it and hope that somebody will bring that to practice. It... What can be taught is anatomy and physiology."*

6.2.2 Burden: An insurmountable volume of learning.

The consensus among the adult-field nursing students is that learning bioscience is difficult. This perspective is also encapsulated in the literature, which has stated that nursing students find learning bioscience difficult in comparison to other topics for many years (Caon & Treagust, 1993; Chapple et al.,1993; Wharrad et al., 1994; Jordan et al., 1999; Gresty & Cotton, 2003; Craft et al., 2016; Gordon et al., 2017). The students that participated in the quantitative phase concur with this perspective with 52.59% ranking bioscience higher than social science and nursing theory in terms of complexity (see Chapter 5). The most cited cause of complexity is the scientific nomenclature of bioscience. Students feel that the lexicon of

bioscience contains too many “big” or “posh” words, which are hard to pronounce and learn. One student suggested that seeing scientific terminology in assessments, textbooks and PowerPoint presentations came as a shock to peers, who suddenly realised they would be expected to not only remember intricate and alien words but also understand and pronounce them correctly.

“…’cause the only time that you’re going to start seeing big words like pathophysiology is in like 2nd year, y’know when they hit you, and that’s how people proper get hit by it hard cos they’re like ‘oh my god’ like ‘what is this?’ – Student 3, focus group 1.

The students recognised that the complex vocabulary of bioscience is a component of health professional language and integral to the culture of healthcare. The challenge of learning this new language, they feel, hinders their learning, and explains why students feel the learning of bioscience is challenging. Furthermore, students feel the litany of abbreviations and SI units appears impenetrable and indecipherable, a concern already highlighted in previous studies (Gresty & Cotton, 2003; Craft et al., 2016). However, their concerns relate to communication and “fitting in” in their environment. The students recognise that many abbreviations and scientific measures are an essential component of the health professional vernacular. If they are unable to learn this vernacular, they feel they cannot contribute to clinical conversations or be active members of the team, a phenomenon also identified by (Montayre et al., 2021). An example of this perspective is encapsulated in this humorous quote, in which one student compares learning pharmacology to trying to master Latin.

“It would be so much easier because I remember trying to learn pharmacology last year and I was just writing down a list of drugs being like [inaudible] meets pain. Like blah blah, I'm just writing Latin, I'm not learning anything here, I'm just learning Latin.” – Student 10,

focus group 2.

At times students describe their learning of bioscience as overwhelming. They feel that while bioscience knowledge is important and valuable, the volume of facts and concepts they need to learn is insurmountable and unknowable. From the student's perspective, complex biological concepts are condensed into a too short a period for learning to occur, view shared by other students (Jordan et al., 1999; Craft et al., 2016) and tutors (Taylor et al., 2015). In response to feelings of being overwhelmed procrastination and futility are common themes, in that students express that learning bioscience is so challenging some students actively avoid it. At times students express a degree of futility, and such is the complexity of learning physiology it is not worth persevering. Expressions of procrastination, which are often referred to, are all made in the context of challenge and difficulty. The student view is that bioscience is complex, intricate, and hard to fathom and, therefore, a significant challenge to learn. In their defence, student nurses are expected to have an insight into a range of physiological phenomena on qualification. To meet the requirements of the NMC, this group of students would have been expected to learn cardiology, respiration, immunity, renal physiology, neurology, pharmacodynamics and pharmacokinetics, anatomy and physiology of the skin, endocrinology, the musculoskeletal system, and microbiology (NMC, 2010). All these topics would have been introduced in 1st year and re-introduced and further explored in the 2nd and 3rd years. From the adult-field students' perspective this extensive list of subjects is overwhelming and impossible to learn, as this quote from focus group 2 demonstrates:

"I think thinking back to erm [1st-year bioscience module] *in first year, I just, when we first started, we had so much to do like erm cardiovascular, renal. I found it very overwhelming*

because there's just a lot to do, there's a lot of information erm, you need to know so much in such a short period, but it's quite relevant and important, important. But I just found first-year biological basis was just quite overwhelming." – Student 6, focus group 2.

The classroom is often referred to in disparaging terms and is considered a hindrance rather than a promoter of education. Huge groups placed in large rooms, a regular occurrence for teaching anatomy and physiology, are unpopular as they are associated with poor behaviour, such as noise or talking, which disrupts learning. Large lectures are also less intimate and associated with feelings of isolation. The students felt that they thrive better in small rooms with fewer peers. Simulation and laboratory learning were also popular among students, who demonstrated an appetite for a direct and tactile approach to their learning. Such opinions are reflected in the literature in which lectures as a teaching method are considered the norm, despite their unpopularity with students (Bakon et al., 2016; Kyte et al., 2023). The frequency of sessions is also important to students. Many feel that regular classes, throughout the academic year, would enhance their understanding. In addition to increased lesson frequency, some students feel they should be subject to regular testing, to ensure they learn and so they can gauge their progress.

At times, the students expressed opinions that unconsciously relate to pedagogy. For instance, students voiced preferences for explorative rather than didactic teaching. This is interesting because there is a tradition of teaching anatomy and physiology through lectures, which invariably include PowerPoint slides that contain diagrams of internal organs (Bakon et al., 2016; Kyte et al., 2023). This didactic approach ensures that biological systems are taught in isolation, something that is not lost on the students, who feel that an explorative approach would enable them to make connections more readily between theory and practice.

A common source of burden was assessment, and specifically the assessment of bioscience knowledge. Assessment of understanding was, in some respects, viewed as a barrier to learning, either because they find the assessment difficult in terms of the knowledge they needed to demonstrate, or they disliked the nature of the assessment, an exam for example. Coupled with the anxieties associated with assessment, is the popular notion that the curriculum is assessment-driven, the theory being that students reduce their learning to a narrow focus, to pass their assessment, rather than spending time learning as much as possible. This suggests students would prefer a move away from tradition assessments to more authentic ways of testing knowledge that are more aligned to nursing practice. As Craft & Ainscough (2015) and Poindexter et al. (2015) argue, assessments that have a greater relevance to the realities of professional practice would be more useful than conventional assessments that render achievement synonymous with grades rather than functional professional knowledge.

The student discourse also reveals a disappointing assessment of tutors. From their perspective, their teaching sometimes fails to inform, inspire, or galvanise them. Analysis of their conversations suggests that students feel their relationships with tutors can hamper or hinder learning. This opinion is not universally applied to all the tutors they encounter, but their collective feedback paints a picture of a group of students dissatisfied with their classroom experiences. Discontent with the quality of bioscience teaching is a long-standing complaint (Chapple et al., 1993) that remains an issue for contemporary students (Mhlongo & Masango, 2020). Research by Taylor et al. (2015) and Craft et al. (2016) suggests that student dissatisfaction is related to a lack of confidence in those that teach bioscience (as addressed in Chapter 2). The students in this study feel some of their tutors may not be up to

date. The following comment is typical of this view of nursing tutors.

"Yeah, and I think as well, it depends how, y'know your lecturer or err their involvement in practice because some people are not active y'know and not always current with y'know the procedures and what's going on" – Student 4, focus group 1.

Some students feel there is a disconnect between the diseases they encounter in placement and what the tutors want to teach. In the example below the tutor selected a rare unnamed condition in a neurology lecture, as opposed to stroke, a neurological condition the students are more likely to encounter. Their disappointment is understandable and suggests tutors should be more judicious in their choice of topics, ensuring they have more relevance to their students. But from the students' perspective this is further evidence that some tutors are out of touch. They infer that tutors prefer to teach the diseases the specialize in and therefore more comfortable with than teach what the adult-students feel they require, which would require them to remain up to date. The following comment is typical of this view of nursing tutors.

"Yeah, on the neuro one they chose the most, the like the least common neuro. Why did they choose [that]*? erm, what does it* [inaudible]*? I don't know but it was just like* [over speaking] *stroke is everywhere, they know everyone's doing stroke whoever's doing neuro. Like no one was doing that. But they specifically chose that just to like not do just stroke."* – Student 8, focus group

Another aspect of dissatisfaction is the expectations tutors place on students. Nursing tutors are encouraged to promote high expectations and promoting high expectations is not only good practice it also ensures a better student experience (Chickering and Gamson, 1987). Nevertheless, attempts to promote high

expectations are interpreted as being punitive and even authoritarian, as the following comment demonstrates:

"If you haven't done your homework you wouldn't turn up to his seminar, you're asking to get roasted." – Student 8, focus group 2.

However, promoting high expectations may be counterproductive in terms of bioscience. When exploring the impact of their education, the students are quick to highlight that they are nurses and not doctors. Their view is that there is a ceiling to the degree of knowledge they require and that at times tutors are pitching lessons at too high a level, leaving students to imagine that their education reflects that of a medical student. From the students' perspective, they often feel tutors fail to recognise their unfamiliarity with biological topics and that adult-field nursing students should be introduced to complex concepts gradually and in basic and unsophisticated terms. As this student highlights when describing a 1st year classroom experience:

"You remember first year we had this lecture on cardiovascular, this lecturer or whoever, he must be a consultant and I thought he must be, he must be thinking he's teaching PhD doctors because the words were like [makes a noise like bullets flying] *I was sitting going like....."* – Student 7, focus group 2.

6.2.3 Angst: Learning bioscience is stressful and induces anxiety.

From the perspective of the students, tutors are sometimes regarded as being aloof or uninterested in their education, or in some instances unapproachable. This view is informed by the notion that the students feel tutors would rather promote self-direction than teach. However, this is counter to their wishes or needs and causes

anxiety and stress. From the students' perspective, greater input, and more access to tutors for tutorial support is required to bolster their learning. For example, this student laments the lack of input from their tutor and is critical of the need to explore topics themselves.

"I feel we're given, like... we're given the responsibility to do everything ourself. To be honest, like, most of the knowledge and everything you learn is outside of, um, class and everything. But it's mostly to do with our own research. So, we're not given anything. And even if we're given resources, it's not like to say, like, that is the main part or... They just give us the books or whatever we need to read but not the relevant parts and sometimes we're just left with so much research and stuff and we don't know which part is the relevant parts, um, in the research, really" – Student 13, focus group 3.

Later in the same focus group, the same student complains that access to tutors for assistance is problematic.

"And I think another thing is the structure, like of the signing us up and stuff like that. Like, they tell us to book tutorials. Half the time the, the tutors are not available or, like, as in, they'll be like, oh, yes, I'm on leave, this, and this and this." – Student 13, focus group 3.

Such opinions or views arguably relate to learning per se and are not peculiar to bioscience. They also, perhaps, relate to the tribulations many students feel when making the transition from school into higher education, which has a greater emphasis on self-direction and development. As Pryjmachuk et al. (2019) found in their analysis of 1st year student nurse experiences, students struggled to adapt to university education and its emphasis on self-determination. However, there may be some relevance to these criticisms if, for students like the one cited above, bioscience causes them anxiety. Throughout the focus groups there was a tangible

sense of anxiety caused by a lack of tutor support, which is reflected in recent research into student anxiety and assessments (Keane et al., 2021). While the criticisms of the students focused on a perceived lack of tutor support or interest, another interpretation is that their angst is symptomatic of their anxiety at learning the biosciences, as they are perceived to be more complex yet simultaneously more important than other aspects of their syllabus. As discussed in Chapter 2, anxiety is a core concept of the bioscience problem, and a common issue highlighted by researchers (Nicoll & Butler, 1996; Jordan et al., 1999; Clancy et al., 2000; Gresty & Cotton, 2003; Friedal & Treagust, 2005; Andrew et al., 2008; Craft et al., 2013). Furthermore, as discussed in Chapter 5, quantitative data demonstrates that contemporary students rank bioscience as the most likely subject area to cause anxiety when compared to social sciences and nursing theory.

At the time of recording the focus groups, the opinion of the participants reflected historic research in that they felt they were going to qualify as being deficient in biological knowledge (Wilkes & Batts, 1998; Campbell & Leathard, 2000; Clancy et al., 2000; McVicar et al., 2010; Craft et al., 2016; Gordon et al., 2017). Put simply, they felt they did not know enough to practise effectively, which is a significant cause of their anxiety. While the students speak positively about the biosciences and often profess a passion for the subject, the mindset of many of the students is that they are ill-prepared for professional practice because they feel they lack the required knowledge of them. Students often use the word incompetent to describe their perceived lack of knowledge and there is a palpable sense of inevitable impending care failure, caused by their insufficient knowledge. This perspective is endemic in all the focus groups, but most especially groups 2, 3, and 4, which at times are confessionals concerning their perceived unsuitability for

qualification. The following quote from group 4 highlights this outlook. Students 18 and 16 clearly fear that their lack of bioscience knowledge will hamper their chances of employment once qualified.

Student 18: "*Yes. It's definitely. But it's... you just... I think everyones had that question that you, you're like starting to look at jobs and stuff and you're like, what do I write on this personal statement because I don't feel like I know anything.*"

Student 16: "*And I think that's where the nerves come from becoming... You know, from a student nurse to a staff nurse, it's like, am I going to be competent enough and am I going to have that knowledge to be able to do my job?*"

Another source of angst is the humiliation and awkwardness they feel when being unable to answer questions asked by a qualified staff, with some confessing to pretending to understand or know more than they do while in placement. The subtext behind the embarrassment and the façade of acumen is that bioscientific knowledge is essential and that a lack of understanding betrays an inability to provide competent care in the eyes of other professionals. Furthermore, the expectations of other professionals and the questions posed by staff nurses are legitimate and justified, because nurses need to be knowledgeable. This explains their discomfiture and the repeated phrase "I should know this." It also reflects recent research, discussed in Chapter 2, which highlights that nurses in the UK and Australia qualify feeling unprepared for the reality of autonomous nursing practice (Craft et al., 2016; Gordon et al., 2017; Redmond et al., 2022). The consensus among these students is that the curriculum is to blame because it lacks bioscience and over-emphases social science and research. The implication is that students feel that in placement they are forced into humiliating situations by a curriculum that does not serve their needs. The anxiety is that their flawed curriculum impacts their

ability to talk to other professionals, especially doctors:

"I remember my second year, they were like, do you know what this is? And I would be blagging, and I'm like, yeah" – Student 7, focus group 2.

"No. It's, okay, so what's going on with this patient? The doctors'll turn to you. 'Cause he hasn't got time to sit and have that half-an-hour conversation. And then you're sitting there in your head going, well, I hope I'm getting it right, you know." – Student 11, focus group 3.

Throughout all the focus groups there is a sense of anxiety about the students' current and future duties. Their exchanges suggest that they are very conscious of the burden of responsibility. Their conversations imply a "their life in your hands" ideal, in which they worry that they will not know enough to conduct their job properly. They are acutely aware that any omission on their part potentially places lives in jeopardy. This reflects a long-established concern among student nurses that they feel they are vulnerable to making mistakes that could harm their patients (Williams & Palmer, 2013; Levett-Jones et al., 2015). However, for these adult-field nursing students the remedy for their anxieties is more bioscience. Their inter-changes suggest that they associate an elevated risk of death specifically with a lack of bioscientific knowledge, especially concerning knowledge of pharmacology. A curriculum with a greater emphasis on bioscience, they assert, will reduce the chances of mistakes, and as result fewer incidence of harm.

6.2.4 The value and discomfort paradox implications for nurse education.

The value and discomfort paradox suggests that for this group of adult-field nursing students their curriculum is unable to meet the value they place on perceived

vital subjects. Their assessment is that learning bioscience is burdensome and that this burden of learning is hampered by a curriculum deficient in quality bioscience teaching. This in turn causes anxiety. In seeking to address the value and discomfort paradox, enhancements to curricula and teaching that reduce the burden and angst associated with learning should be sought. For the adult-field nursing students in this study, the solution is quite straight-forward. The amount of classroom time dedicated to the biosciences should be increased. However, while this request has logic, it is problematic in that bioscience must compete with a range of vital topics for classroom time (NMC, 2018b). Furthermore, it is noteworthy that academics seeking to enhance bioscience education in nursing do not suggest increasing the volume of bioscience. Rather, changes in pedagogy that increase the visibility and relevance of bioscience are recommended. Manchester & Roberts (2025), for example, in their systematic review of 98 studies from 28 countries recommend blending learning, active learning, and stronger links between practice and theory in addition to enhancing the teaching skills of tutors. Collectively, their recommendations are a rejection of the traditional pedagogy, which is reflected in the findings of the small-scale study by Craft et al. (2016), which found that nursing students prefer active learning approaches to traditional lectures when learning biomedical sciences. Maude et al. (2021) rather than recommend increased classroom time highlight authentic assessment as a solution. The argument being that allowing students to problem solve within recognisable clinical contexts enhances the relevance of bioscience and reduces the burden of learning. As Chapter 7 will discuss, future research exploring ways to mitigate the value and discomfort paradox should follow two avenues of research, authentic assessment

and a rejection of traditional methods of teaching in favour of blended or active learning.

6.3 The "value and the reality of nursing practice" paradox.

This section will argue that a further paradox exists within nurse education. As with the "value and discomfort" paradox, it exists because students value and desire bioscience knowledge. However, in this instance students simultaneously find learning and applying its principles in practice challenging producing a "value and the reality of practice" paradox. As with the "value and discomfort paradox" there are opposing tensions to the value students place on bioscience, in this case, the concepts of value and identity. These two concepts relate to the student's relationship with learning in practice, or more specifically with the qualified nurses and allied health professionals they work with. Analysis of both concepts will conclude that their origins are rooted in work-based activities and reflect the students' desire to qualify and provide excellent patient care.

6.3.1 Reality: The challenge of learning bioscience in practice.

The students feel there is a discrepancy between the reality of nursing and their experiences in the classroom. As the quote below demonstrates students feel that what is taught in the classroom does not marry with what happens in practice.

"…in practice and I think sometimes it feels like there is a disconnect, between what you're told at university and what you do in, in practice [pause]. *To a certain degree."* – Student 1, focus group 1.

The students also discuss theory in isolation as if it is completely detached

from placement, and that what is taught does not relate to their lived experience of collaborating with staff nurses. This criticism is mostly, but not exclusively, aimed at non-bioscience topics such as evidence-based healthcare or research. Nevertheless, the students do tend to address academia as a wasteful exercise, which does not inform their practice, hinders learning and exacerbates their anxieties. The following exchange from focus group 2 suggests these students feel there is a disconnect between theory, skills, and the reality of clinical placement:

Student 10: "I do feel like there's the, there's not a connection between the, what we learn here and then what we do in practice."

Student 6: "Yeah, it's a bit disjointed, I think."

Student 10: "Like we've got our placement stuff where you just do practical stuff and there is no biology and then we've got the biology but then there is no practical and we're just thrown into this job where we've got even more to learn, and we've also got to bring it all together. But we've had no experience of sort of like bringing it together and stuff."

The students' perspective of education and practice as two different entities should not be surprising given there has been a historic perceived division between nurse education and nursing practice. Nursing degree courses, for example, are split into theory and practice blocks that reinforce this view (Monaghan, 2015).

Another disparity addressed is the lack of relationship between methods of assessment and the reality of placement. While, as above, many of their criticisms concerned non-bioscience topics, some of the assessment methods chosen for derision were used to assess biological principles for this cohort of students. In the quote below, which is typical, the student jokes about the relationship between academic assessment and caring for a patient.

"A lot of people on the course have a lot of potential, it's just wasted on essays and it's like oh do an essay. It's just like well if a patient comes to me, I'm not going to, it's like you've got asthma, here's a 2,000- or 4,000-word, long-term condition assignment. [Laughter]" – Student 10, focus group 2.

It was also evident that these students' attitudes towards their academic work were reflected in in those they worked with. The following quote, for exchange from focus group 3 for example, suggests that their clinical colleagues may betray a nonchalant attitude towards academic work:

Student 12: "*How's the assignment going to be relevant once you go…."*

Student 11: "*And every nurse in practice says it. They go, oh, yes, it's a load of rubbish at uni, you know."*

These tensions between academia and clinical practice manifest because of a lack of a cohesion between two aligned communities viewed as being very separate entities (Leonard et al., 2016). Such comments are symptomatic of what Cardwell et al. (2019a) describe as an "us versus them" attitude existing between academics and clinicians and that qualified practitioners must decide which camp they belong to. Nurses that become full time academics, for example, will be seen as switching sides rather than joining another part of the same department.

As stated earlier, the consensus is that the classroom is completely divorced from the reality of clinical practice. It is worth noting that one aspect of this disparity is that the classroom cannot recreate the challenges and stressors students face in the reality of clinical situations, where lives are at stake. The students in one focus group offer a solution to this, which contradicts their earlier criticisms. They discuss an assessment that evaluates their ability to assess a deteriorating patient. In the

following exchange from focus group 2, students evaluate this assessment method positively and highlight that such observational assessment methods, and therefore by implication, classroom-based, can enhance their learning.

Student 6: "*I find the OSCE* [Objective Structured Clinical Examination] *to be really good because I found a little picture of myself actually handing over and doing the SBAR* [Situation Background Assessment Recommendation]*."*

Student 8: *"The SBAR yeah."*

Student 6: *"Again, relevant when you go on placement."*

Student 8: *"Yeah. Definitely."*

Student 10: *"I thought it was good because it sort of puts you in that situation because it happens quite a lot where you get a, somebody comes into your ward and then like you know nothing about them. It's just like you get an incomplete handover. So, it's just like well these are the things I need to know, you have to ask questions to find out..."*

Student 6: *"Exactly. You prioritise them as well don't you."*

Student 10: *"Yeah. So, I thought that was quite good I feel, I feel like more practical assessments would be quite good and stuff."*

While the common opinion among the participants was that clinical practice is the ideal place to learn and apply bioscience, this was not always reflected in their experiences of collaborating with qualified nurses and allied healthcare professionals. The practice placement landscape, described by the students, is one of chaos, overload, workplace politics, fear, suboptimal practice, and unsatisfactory support, which is occasionally punctuated by moments of inspirational teaching and personal development. This viewpoint is reflected in the research by Fell et al. (2016), which found that while 97% of their students felt that discussion of

biosciences in placement was essential to their learning, 41% felt such discussions were all but absent.

The chaotic and demanding nature of front-line health services acts as a barrier to learning. Rather than ask questions or seek clarification, students seek to assimilate into the ward team by demonstrating they are conscientious and diligent individuals. The key to surviving placement is to “knuckle down” and “not rock the boat,” and to accept what is happening around you and not make a fuss. This attitude is commonplace and a key concern for nurse tutors and clinicians alike (Keates, 2022). The net result is that student ingratiate themselves into a team, but no bioscience learning has occurred. Associated with this idea is the feeling of being a burden. Students feel that asking questions or seeking clarification places a burden on busy staff, and therefore avoid doing so, another identified phenomenon in clinical practice that explains why student nurses are reluctant to report of sub-optimal care (Brown et al., 2020). In some instances, however, students avoid asking questions because doing so may betray a lack of knowledge or understanding. As this exchange from focus group 2 implies, both lack of knowledge and fear of being a burden can discourage students from asking questions in clinical practice.

Student 9: *“In university I feel safe asking but at work I feel like stupid and like I don't think I should be asking that because they, because in university they expect us to* [ask] *at work they expect us to know like yeah...”*

Student 8: “*And they're always stressed you just, because sometimes you just feel like you can't ask them and that's because they're always stressed.”*

While in some circumstances these feelings may be misplaced, some

students feel they are made to feel “in the way,” which they feel is not conducive to learning. A common complaint is that rather than shadowing and learning from nurses, they are working as healthcare assistants and completing menial work, which while important, detracts from their main goal of learning bioscience. This perspective was present in all the focus group discussions and the following example is typical. Here, student 1 is lamenting a missed opportunity to engage in learning something biological as they have been asked to replace an absent healthcare assistant and complete their duties.

“*Yeah, when the matron comes up and goes “right I’m taking, I’m taking the bank, I’m taking the bank HCA off to this ward “...oh but we’re not in numbers. Nah nah, you’ve got a student, you’ll be fine”, it’s like “oh alright so I know what I’m doing today…….none of the things I’d planned to do…..lots of washes today. But anyway…..”* – Student 1, focus group 1.

As above, the work of Fell et al. (2016) also aligns to this view. The students in their study observed that staff shortages impacted on their bioscience learning, which was often shelved in favour of perceived routine and mundane tasks such as washing patients and completing observations. The view that student nurses are used as healthcare assistants is also commonplace as Jack et al. (2018:932) found, students frequently complain they are being used as a “free pair of hands”. However, the implication in the focus group discussions was that the students felt completing tasks that they perceive to be menial comes at the expense of their learning the biosciences.

Ward culture, ward politics, or staff relations are also viewed as a barrier to learning. The implication being that poor working relationships between staff result in poor placement experiences. At times nurses appear unapproachable and students feel they cannot engage with them. One student described working in a

toxic environment, in which engagement concerning learning was futile.

"Yeah, I think as well, going through your course, you're looking at your placements as well aren't you; you want to feel that passion, you want to be inspired. Y'know some places you go, and you think 'definitely don't wanna work there'." – Student 4, focus group 1.

Students categorise their placement experiences into good and bad areas, implying that learning only occurs in the good areas. The characteristics of good and bad areas are determined by the student's opportunity to gain experience biosciences. For example, some clinical areas are known for their elevated expectations of the students, in terms of their biological knowledge, and some feel they are unable to meet those expectations. Some clinical areas are considered good because they are bioscience sensitive and have a positive attitude towards anatomy and physiology. Such workplaces tend to have an acute focus or are considered a specialism, for example, Accident and Emergency, Theatres, or Coronary Care. Clinical areas that are bioscience sensitive are deemed dynamic and have student-friendly nurses who nurture their students. This opinion is, again, reflected in the work of Fell et al. (2016), who also found that students characterised nurses as either good or bad depending on their attitude towards bioscience. Good nurses pushed bioscience and encouraged learning, whereas bad nurses ignored questions that related to bioscience. The student below describes one such area and how staff encouraged them to explore bioscience and therapeutic decisions each day.

"like on the, er for example, my last erm placement, err pretty much er, it was pretty much every day, you used to go in you'd just have a random drug chart and they'd just take me in the back office and he was like 'right, what are these and what's wrong with the person then?', and then erm, he would like err, just go through it 'so why are they taking that, if

they've got that', so you just have to, I had to research it so it was encouraging for me to research it and then he was like 'right, before we even looked to, err looked at the patient' and then he'll go in and go 'right, this is what it actually is but yeah I can see where you're going from' or and just encouraged you" – Student 2, focus group 1.

In contrast, bad placements do not foster enquiry, and therefore learning is hampered by poor practice or what the students refer to as "bad habits." Others point to a lack of leadership, with senior nurses too concerned with management tasks and meetings, remaining in their offices while nurses are left to cope on busy wards, unable to provide time to instruct their students. The students do, however, make connections between what they consider to be well-run and dynamic clinical areas and the nurse's willingness to teach or even promote the biosciences. Clinical environments which students perceive to be less effectively managed are considered synonymous with a reluctance among staff to teach or discuss the biological underpinnings of care. As the following student suggests, during their placements in less well-organised wards, their practice supervisors were reluctant to explain the bioscientific basis of their work, or even engage in a discussion about it. Similar opinions can be found in the qualitative data in a study by Davis (2010). In their study recently qualified nurses reflected on their experiences in placement and stated that while in clinical practice bioscience was rarely discussed as this quote demonstrates.

"…you went on the wards and nobody asked did you relate what you had learned to what you were practising." Davis (2010:750).

The focus group dialogue also highlights that adult-field nursing students feel they respond positively to nurses that are perceived to be inspiring role models. In contrast they have clear ideas on what constitutes a poor role model. A good role

model can explain and rationalise care choices using bioscience. Poor role models are unable to do so and may also be unwilling to tutor the students or even engage with them. Often, when students ask questions, their mentors evade answering them or give vague responses that suggest a lack of insight or autonomy. The students in these focus groups find examples of low autonomy uninspiring and deflating, as the following typical exchange indicates. In this scenario from focus group 2, the students are incredulous that a staff nurse would defer to a doctor instead of making an autonomous decision. There is also a degree of incredulity that the nurse was unable to explain the blood results.

Student 10: "*I also find like sometimes when you speak to nurses about this they're just like oh no that's, that's doctors' jobs and it's like mmmmm...*"

Student 8: "*But you have to know what every-, you have to know.*"

Student 6: "[over speaking] *I find the CCU like trying to learn about bloods, it's kinda like, oh well you just need to let the doctor know if it comes up red. It's like well what does it mean? It's red? But what does that mean?*"

Student 8: "*Like you need to know.*"

Student 10: "*Like here you go doctor, it's a piece of paper and it's got a bit of* [over speaking]"

Student 6: "*It's quite embarrassing.*"

This lack of autonomy or unwillingness to impart knowledge is a common thread throughout the focus groups. In many respects, this is an inconvenient truth, in that the students believe that many of the nurses they work with do not understand bioscience or do not care about the biological underpinnings of their work. Again, this notion is reflected in the study by Fell et al. (2016) who found that a third of the students in their study reported that their mentors, bioscience knowledge was less

than good, with 21% grading it as fair or poor. In this study the conviction that staff possess inadequate knowledge of the biosciences is seemingly exacerbated by two beliefs, firstly that much of the knowledge that is passed on from generation of nurse to another is not up-to-date and is likely to be nothing more than folklore, and secondly, that misinformation is passed down through the generations of nurses, ensuring pockets of poor practice and deficiencies in knowledge. It is interesting to note that some of the students in this study felt there is too much deference to more experienced nurses, who they perceive to be lagging in their knowledge, and that it is their responsibility as up-to-date practitioners to challenge those lacking in bioscientific knowledge.

"And we should be, as newly qualified nurses and student nurses, bringing out as much autonomous knowledge that we have of physiology into practice. We should be able to say, actually, this is what's out now. Rather than, well, we often sit back and take the older nurses' point of view." – Student 11, focus group 3.

While the students have respect for their practice assessors and supervisors as nurses, that respect is not always extended to their qualities as teachers. This group of students expect their practice colleagues to be efficient teachers, but in their experience the opposite is true. Another, aligned perspective, is that nursing staff do not want to teach and are reluctant to coach and mentor future nurses. From the student's perspective, there is a sense that their learning is at the mercy of a lottery. Those that are lucky to be allocated a dynamic mentor, for example, will thrive, whereas those that are allocated a poor role model will not progress, even if they are placed in a dynamic and bioscience-friendly area. The following two quotes, from different focus groups, indicate the antipathy some students have against the practitioners responsible for teaching them in clinical practice.

"It's like mentorship. I don't think mentorship can be taught. I think you're either willing to teach somebody and help somebody and have that. You can't sit there and say to somebody, you should do this. Because you meet mentors that are really horrible all the time. They don't want to teach people……..But I think mentors need to get the idea in their head that we need to be taught. Even at third year, I need to be taught. Like, I know you expect so much but I need more knowledge too." – Student 11, focus group 3.

"And sometimes I wonder if that's, if that's the culture of the setting that you're in or if it's I mean I haven't been on cardio-thoracics so this about a, a unit in general, but erm, y'know you could go to a cardiothoracics and absolutely hate it but that could be because your mentor is standoffish and doesn't want you there." – Student 1, focus group 1.

These quotes arguably betray a lack of insight into the reality of learning in practice. All nurses will be under pressure to maintain high standards of care in challenging and chaotic environments. Time for quality teaching will be a luxury in many frontline services. As Molesworth & Lewitt (2015) contend, nurses are coping with a high workload and chaotic nature of clinical practice, which will leave little time for teaching. Nevertheless, their criticisms do reflect the view that the teaching of the biosciences in clinical practice lacks depth and does not meet their expectations. Furthermore, from their perspective this lack of quality practice-based teaching contributes to their lack of biological insight and the anxiety that induces.

6.3.2 Identity and its impact on learning.

While students identify as caring individuals, they also identify as being serious professionals. In their view, there is a contradiction between how nurses are viewed by sections of the public and how they view themselves as autonomous

practitioners. The students feel the public has a patronising view of nurses, which considers them to be angels who help people feel better. Whereas the students view themselves as medical professionals who make life and death decisions. There is a narrative of rebellion against an old-fashioned view of nurses being nice people. Being a nice nurse may be what the public expects and yet conversely, being nice will not keep the public safe. To keep people safe, nurses need to be professional and possess an adequate level of knowledge of bioscience.

"*I feel like the way the nurses are being portrayed in the media, is having an adverse effect on everything, even down to our education. We're portrayed out as these, like, angels. Like, we're so clean-cut. We're meant to be amazing. All this stuff. And, like, this umbrella terms happens. And then we're not being taught the right things then because some people go, oh, you're here to be caring and to rub people's heads and tell them it's all okay. But no, I'm not. I'm here to actually be a medical professional and make sure your life is safe"* – Student 11, focus group 3.

The expression of angst by student 11 is reflective of the disquiet among the nursing profession and its long running battle to establish itself as a serious autonomous profession in the face of favourable public opinion that regards them as ministering angels rather than highly qualified technicians. While the public's perception of nursing has changed significantly since the 1990s (Jinks & Bradley, 2004) it is still sometimes viewed as a vocation for kind, caring, and strong people who are less intellectually able (Glerean et al., 2017). Furthermore, when considering the recent challenges presented by a pandemic, the comments by student 11 are prophetic. COVID-19 brought this viewpoint to the fore with nurse academics highlighting that the associated shower of affection by the public rather than elevating nursing only served to reinforced stereotypical images of nursing

being a feminine and nurturing vocation (Stokes-Parrish et al., 2020).

The consistent view by this groups of adult-field students is that they are professionals in need of a solid foundation of bioscientific knowledge to practice and rid themselves of the ministering angels or doctor's handmaiden label. This view, however, contradicts, to a degree, the assertions of Logan and Angel (2011) who described a nursing-science tension. Their assertion is that there is a cultural rejection of the biosciences by nurses who identify themselves as carers and not "bedside scientists." The dialogue from these four focus groups indicate that this is not the case for this group of adult-field nursing students, who favour bioscience and see it as a gateway to effective care.

The way students express themselves during their discussions often alludes to feelings of low self-esteem, especially when comparing themselves to other professionals such as doctors or physiotherapists. All these expressions of low self-esteem are in response to discussions about their levels of bioscience knowledge. Students compare their progress and knowledge with several other groups, including other nurses. While one might expect comparisons to be made with other members of the multidisciplinary team, such as doctors, dieticians, and physiotherapists, they also compare themselves to nurses of the future, those that will qualify after them. This group of students believed that the forthcoming NMC pre-registration education standards (NMC, 2018b), published the year the focus groups took place, would mean that their future colleagues would be more bioscience savvy and competent in skills more traditionally associated with advanced nursing, such as cannulation and prescribing.

In addition to feelings of incompetence, the students also express embarrassment at their inadequacies. Students often compare themselves with

other groups, for instance, students from other universities and nurses qualified overseas. They also compare themselves unfavourably with other professions, in particular doctors and physiotherapists. The students also felt inferior to nurses qualified overseas and employed in the NHS to bolster the nursing workforce. The students in this study readily accepted that those qualifying outside of the UK have a more in-depth insight into the biosciences, especially regarding pharmacology. The students cite Italy, Spain, and Portugal as examples of countries that ensure their nurses qualify with a greater understanding of anatomy and physiology. This is viewed as an injustice, and as a result they are at a distinct disadvantage clinically, there is even suggestion of ridicule from overseas nurses regarding their knowledge levels.

"But if you think about the nursing degree like in other countries abroad it's so much better. They learn all of the pharmacology, they learn, they learn like so much bioscience and it's nothing compared to here. And there'll be like the foreign nurses, they'll come in and be like, what do you guys even learn?!" – Student 8, focus group 2.

The sub-text of these conversations regarding overseas nurses is that jealousy exists at what they perceive to be better education and a more comprehensive bioscience knowledge base. This enhanced knowledge base was attained because education systems in Italy, Spain, and Portugal are more effective than in the UK, which reflects a commonly held belief among British nurses that foreign nurses, especially in Europe, the USA, and Australia, qualify with a greater knowledge base and skill set than their own. This is based on overseas nurses being competent in skills not normally practiced by nurses in the UK and overseas nurses reporting being deskilled in NHS settings (Bond et al., 2020).

An analysis of how the students view themselves as learners also highlights

why they feel the learning of bioscience is challenging. Throughout all the focus groups the students betray a lack of self-belief, and often express doubts about their abilities in practice. There is a sense of feeling lost or being out of their depth and that learning bioscience in placement is overwhelming. Indeed, there is a view that students have no voice, that their views are not considered and that no one is listening to them. They also see themselves as completely subservient to everyone they encounter in placement, which adds to their lack of self-esteem and self-belief. This lack of autonomy and low self-esteemed is a common description of the clinical practice experience and is related to a low external locus of control. As Wynne & Garrow (2024) discovered, when discussing placement experiences student nurses describe a lack of perceived control over their learning, which is the main cause of their stress. For the students in this study their subordinate feelings are exacerbated by their perceived lack of bioscientific knowledge. Their discussions also indicate that their lack of bioscientific knowledge is a source of ignominy, which manifests as fear, anxiety, low self-esteem, and shame. All these associated emotions were apparent in all the focus groups but this quote from focus group 4 is typical of this view.

[in reference to the discussion stimulus] *"So it's like it's telling me that there's more for me to learn, you know. So, if I come across something like this at this moment, I'll be like, oh no, I have no clue. And that can be very embarrassing as a third-year student."* – Student 20, focus group 4.

There is a perceived injustice, expressed on several occasions and always in the absence of detail, that other University's curricula or level of knowledge and understanding of anatomy and physiology outstrips theirs. Their view is that students attending different universities receive a higher standard of bioscience

education simply because that university has a different approach. However, while vagaries between institutions are inevitable, all UK nursing curricula are based on the same set of standards, and therefore all nurses in the UK study the same topics (NMC, 2018b). Nevertheless, this is their perception, which suggests that they have little confidence in their bioscientific knowledge and curriculum, as the following quote illustrates:

"[Speaking about a student from another University] *She was from* [a neighbouring institution] *and her knowledge actually about biology was so much higher than mine. And really it actually scared me a little bit"* – Student 9, focus group 2.

Analysis of the focus group discourse also suggests that the students often see themselves as victims of poor service or simple circumstances. However, they reserve their biggest objections and ire for practice placement, in particular the NHS and its workforce. The students feel they are unable to dedicate time to their studies or to learning from colleagues because the NHS is understaffed and under-resourced. In this exchange from focus group 4 the students discuss reading articles as a way of keeping up to date, the broad point is that student and qualified nurses are too busy to read literature:

Student 20: *"Yes, I get what you're saying but you ask yourself how many qualified nurses now, in the ward, go back to read articles?"*

Student 18: *"Oh God. None."*

Student 20: "*You know, you go to wards, you are so busy, you come back home. Who is going to take articles to carry home?"*

The NMC argue that staff should spend 20% of their time with their allocated students (NMC, 2023c) and ward managers should also provide protected time for

staff to discuss a student's progress. The students believe this does not happen and they cite busy wards and a lack of staff as the cause. The implication being that the NHS is too busy an environment for learning to take place. This view is endemic in nursing literature, with recent research reinforcing this group of students' claims. Thomson et al. (2017) for example, found that final placement students highlighted a lack of support due to understaffed clinical areas had been a constant throughout their training and had continued to hinder their learning and progress. In 2018, Harrison-White and Owens (2018:80) highlighted that many students realise early in their course that workload pressures will result in them coming a "poor second to patients".

6.3.3 The value and reality of clinical practice paradox: Implications for practice.

The value and reality of clinical practice paradox suggests that for this group of adult-field nursing students their practice placement experiences are unable to meet the value they place on perceived vital subjects. Their assessment is that learning bioscience in clinical practice is hampered by a combination of poor clinical teaching and demanding clinical work in busy frontline services. Their unsatisfactory learning experiences are complicated by who they feel they are viewed by their clinical colleagues and society. In seeking to address the value and reality of clinical practice paradox, enhancements to curricula and teaching that seek to enhance how bioscience is taught in clinical practice should be sought. As highlighted in section 6.2.5 Manchester & Roberts (2025) recommended, in addition to blending and active learning, stronger links between practice and theory. They use the work of Molesworth and Lewitt (2016) and Fell et al. (2015) to justify this recommendation

but the qualitative data from this thesis, which presents an acute dissatisfaction with clinical learning, reinforces this recent advice. Perhaps this guidance should not be surprising given the historic partition between universities and health providers (Greenway et al., 2019). Nevertheless, in addressing the value and reality of clinical practice paradox, future research should explore how links between university and practice educationalists could refined and strengthened. Chapter 7 will, therefore, also explore strengthening the relationships between academia and clinical practice and their impact on the adult-field nursing students' learning of the biosciences.

6.4 Conclusion.

This chapter analysed and discussed the research findings described in Chapter 5. The quantitative and qualitative data generated six distinct concepts that describe the student nurse experience of learning the biosciences required for clinical practice. Collectively they present educationalists with two tensions or paradoxes that explain the burden of learning bioscience from the adult-field nursing student perspective. There is a tension between the value students place on bioscience and the discomfort they describe when learning them and their struggles to learn bioscience while working in clinical settings. The next step is to seek to address both paradoxes and enhance the student learning experience. The next chapter explores possible avenues for future research into pedagogy, such as blending and active learning, and investigations into how education links between education institutions and practitioners can be enhanced.

Chapter 7

Limitations and recommendations

This chapter identifies two major limitations of this research and argues that repeating the questionnaire and focus groups with a wider sample in the future could counteract them and strengthen the findings of this thesis. The chapter also explores the potential avenues for further pedagogical research that seeks to address the value and discomfort and the value and reality of learning in clinical practice paradoxes highlighted in Chapter 6. Solutions to the value and discomfort paradox, for example, could lie in a rejection of traditional teaching methods and greater emphasis on blended or active learning, and the pursuit of authentic bioscience assessment. This chapter explores the current evidence for these pedagogical ideas with a view to future research on their applicability to the enhancing the learning of the biosciences. Likewise, as also discussed in Chapter 6, the value and reality of clinical practice paradox could be resolved if stronger links are established between academics and clinical staff. This chapter will, therefore, conclude with an analysis of why enhanced working relationships between university-based tutors and practice-based nurses could enhance learning and why bipartisan working has traditionally impeded inter-institutional working.

7.1 Repeating the questionnaire and focus groups.

Acknowledging the major limitations of this thesis is an attempt to reinforce the authenticity of the research and encourage trustworthiness in its findings (Aveyard et al., 2023). This section will argue that repeating the questionnaire and the focus groups will not only counter the study's limitations but also fortify its

findings (Nieswiadomy, 2013). There are two major limitations to this thesis that could be addressed by repeating the questionnaire and focus groups, namely:

- The data is based solely on the experiences of adult-field nursing students.
- The described experiences are based on an out-of-date curriculum.

The first limitation relates to the pragmatic decision to focus on adult-field nursing students. As discussed in Chapter 4, the students invited to take part in this research were purposefully selected. While this decision is open to criticism it was justifiable because the sample best ensured the research questions were answered in that they were all currently learning bioscience for nursing practice (Parahoo, 2014). Furthermore, seeking to explore the experiences of the students that I worked with every week was in line with the advice of Silverman (2010) who recommended novice researchers start with what is familiar to provide more time and energy for analysis.

However, it could be reasonably argued that this pragmatic decision has resulted in a one-dimensional view of bioscience in nurse education. The NMC standards for pre-registration have always stipulated that bioscience should be an integral element of curriculum for all four fields of nursing, i.e., Adult, Child, Learning Disabilities, and Mental Health (NMC, 2010; NMC 2018b). While the findings of this thesis represent the lived experiences of the students that I encounter and therefore describe the professional world I inhabit, they will not reflect the whole nursing profession. The NMC does not differentiate between the four fields in terms of what bioscience is required for each field. However, the needs of each field are arguably different. The focus of bioscience in nursing is viewed as encompassing the functionality the whole human body (Peate & Evans, 2020), however, for child-,

learning disability-, and mental health-field nurses there are nuances in the bioscience that informs their practice. For children's nursing, for example, there is a greater focus on development and growth and the anatomical and physiological changes that occur throughout childhood (MacGregor, 2008). Similarly, learning disability nurses argue that a major bioscience influence on their practice is genetics (Gates & Mafuba, 2023), whereas the focus of the biological basis of mental health nursing is neurological (Blows, 2021). Investigating the perspectives of non-adult nursing students, therefore, would provide an interesting comparison and determine whether their experiences match those of their adult nursing colleagues. For example, do the non-adult students feel equally overwhelmed with their learning and do their experiences of learning physiology in practice align with the adult-field nursing students?

The historic evidence discussed in Chapter 2 suggests that all students experience similar issues. For example, much of the research executed in the UK in between the aftermath of project 2000 and the introduction of the all-graduate route to nursing (1993 and 2010), focussed on students in their 1st and 2nd year of study. Prior to the termination of non-degree routes into nursing, these students were completing what was historically termed the common foundation programme (CFP), the introductory part of their course in which students of all fields studied together and learned from each other. Therefore, many of the early studies that hypothesised biosciences as problematic were based on data from all four fields of nursing (Chapple et al., 1993; Nicoll & Butler, 1996; Jordan et al., 1999; Davies et al., 2000; Ofori, 2000). Only two UK studies from this period examined a specific field. Mowforth et al. (2005) only explored the perspectives of adult-field nursing students whereas Jordan et al. (2000) selected only mental health-field students. The latter

study was executed specifically to determine whether the CFP met the needs of mental health-field students in terms of bioscience for practice. Their conclusion that it did not, particularly in terms of pharmacology, suggests that the experiences of those mental health-field students mirrored their adult nursing peers.

Three UK studies explored the student experiences of bioscience since the move to an all-graduate route into nursing. Andrew et al. (2015) and Molesworth and Lewitt (2015) both sought the perspectives of students on the biosciences but neither specified the field they were studying. Only Fell et al. (2016) specified the fields of their participants and including students from adult, child, and mental health fields in their questionnaire and focus groups. Their analysis found no difference in attitudes towards the biosciences between the adult- and child-field students, with both fields highlighting similar challenges and difficulties. Repeating the questionnaire and focus groups would, therefore, strengthen the findings of this thesis in that the data could confirm the commonalities between the perspectives of adult- and child-field students.

There were, however, subtle differences in the perspectives of the mental health students who participated in the study by Fell et al. (2016). While there were no significant differences in perspective between the adult- and child-field students, the mental health-field participants placed a slightly lower value on the biosciences and were less likely to engage their practice colleagues in conversations about how bioscience influences of care. Furthermore, none of the studies conducted since 2010 include any reference to learning disability nursing. There is, therefore, no current insight into the value learning disability-field nursing students place on bioscience or their experience of learning it in class or in practice. Repeating the questionnaire and focus groups would, therefore, also provide some much-needed

insight into the lived experiences of students from mental health and learning disability programmes.

Repeating the questionnaire and focus groups with students on a current curriculum would also overcome the second major study limitation. The participants of this study completed a degree based on the 2010 NMC standards (NMC, 2010). The current standards were published as the data was being collected and analysed (NMC, 2018b). The 2018 proficiencies for nurse education are arguably more explicit about the need for qualifying nurses, from all four fields, to possess appropriate levels of bioscience knowledge. This is best demonstrated by Platform 3 – Assessing Needs and Planning Care, which states that at the point of registration all registrants must:

"Demonstrate and apply knowledge of body systems and homeostasis, human anatomy and physiology, biology, genomics, pharmacology and social and behavioural sciences when undertaking full and accurate person-centred nursing assessments and developing appropriate care plans" NMC (2018b:14).

Indeed, as Perkins (2019) argued, the 2018 proficiencies highlight a need for a greater volume of bioscience teaching and learning, suggesting that in addition to Platform 3 – Assessing Needs and Planning Care, Platform 2 – Promoting Health and Preventing Ill Health, Platform 4 – Providing and Evaluating Care, and Platform 6 – Improving Safety and Quality of Care also require high levels of bioscience knowledge and therefore 60% of all nursing curricula. Considering this increased emphasis on the biosciences it would be prudent to examine whether changes made to curricula in response to the latest NMC standards have had a tangible impact on

student nurses' perspectives of their learning of bioscience. Firsthand experiences suggest that the perspectives of students studying today mirror those following the 2010 NMC standards (see Chapter 1, section 1.5). Repeating the questionnaire and focus groups would, therefore, would also provide an opportunity to confirm if those observations are a true reflection of the contemporary student experience.

7.2 Further pedagogical research.

This section will argue that there are three potential research routes that could lead to solutions to the "value and discomfort" and the "value and the reality of nursing practice" paradoxes and ultimately enhance the student experience. These three potential research routes are:

1) Student-centred teaching – As discussed in Chapter 6 section 6.2.4 Manchester & Roberts (2025), recommend the rejection of traditional teaching methods and re-appraising contemporary pedagogies which use a blended or active learning approaches, such as use of video, the flipped classroom, and virtual reality to enhance bioscience learning.
2) Authentic assessment – As identified in Chapter 6 section 6.2.4, an alternative to increasing classroom time would be to utilise authentic assessments. As Maude et al. (2021) argue, allowing students to problem solve recognisable clinical issues could reduce the burden of learning.
3) Enhanced working relationships between university-based tutors and practice-based nurses – As highlighted in Chapter 6 section 6.3.3 Manchester & Roberts (2025) recommend a more rigorous symbiotic bipartisan relationship between universities and practice placement settings as a method of improving practice learning.

7.3 Student-centred teaching.

Nursing literature is awash with suggestions on how best to teach and learn the biosciences (Evensen et al., 2020). As new teaching technologies emerge nursing academics have been historically quick to sample and test their effectiveness. This section seeks to explore current thinking to establish if blended and active learning pedagogy could counter the “value and discomfort” paradox and enhance the learning experience. As discussed in Chapter 6 the students in this study discussed the classroom pejoratively and considered lecturers a hinderance rather than a promoter of learning. Large group sessions are associated with disruption and isolation. Indeed, there was a rejection of all didactic methods, with students advocating explorative student-centred learning methods, which they felt would enable them to make clearer connections between theory and practice. This perspective also reflects current thinking regarding enhancing the learning and teaching in higher education where current trends tend to reject what are viewed as traditional methods, i.e., lectures or “chalk and talk” classroom sessions (Moellenberg & Aldridge, 2010; French & Kennedy, 2017; Manchester & Roberts, 2025). The teaching of the biosciences has a tradition of didactic teaching, in which tutors, historically non-nurses, point at and discuss a series of anatomical diagrams (Davies et al., 2000) and it is noteworthy that for this group of students the biosciences had been taught primarily as a series of lectures, each dedicated to a body system, in large lecture theatres.

Analysis of recent research into modern student centred and active learning approaches suggests a move away from traditional teaching has merit in terms of what is important to the students regarding their overall satisfaction, and therefore by implication, comfort. However, there is scant evidence that a switch away from

didactic approaches would enhance their academic performance in terms of grades and marks for assessments. The remainder of this section will examine the key proposed changes to the learning and teaching of the biosciences advocated between since 2018, namely use of video, the flipped classroom, and virtual reality (Betihavas et al., 2016; Montayre & Sparks, 2018; Noetel et al., 2021; Mata et al. (2022).

The use of video to enhance learning has been increasingly popular within higher education, especially since the advent of COVID-19 and the enforced shift to on-line learning. However, videos have been used to good effective since the early seventies (Noetel et al., 2021). Benefits of videos centre around what Noetel et al. (2021) refer to as changes in cognitive architecture. By expanding the number of channels by which information is disseminated, i.e., by enhancing the visual as well as aural, learning is enhanced. Textbooks provide an example of single channel dissemination whereas face-to-face teaching has multiple channels. While similar in cognitive architecture, using videos provides the student a chance to manipulate their visualisation (by pausing or rewinding) adding another channel. This notion may explain video's popularity among student nurses. As Montayre & Sparks (2018) discovered in their survey analysis of nursing student's preferred teaching methods, videos were regarding as the most useful study material with textbooks being the least popular. Two recent research studies have explored the use of videos to enhance the learning of bioscience, both of which concluded that supplementing traditional methods with videos enhanced the student experience (Grønlien et al., 2021; Mata et al., 2022). Grønlien et al. (2021) provide the only recent evidence of videos having a tangible impact on academic performance. A higher proportion of students accessing videos to supplement their learning of the biosciences achieved

“A” and “B” grades. However, only minor increases were witnessed (6.2% and 5.23% respectively) and the proportion of students achieving grades “C” to “F” were similar for students using videos and those that didn’t. Nevertheless, the students utilising videos reported fewer expressions of difficulty in learning bioscience concepts. Mata et al. (2022) explored the impact of short movies and concept maps. The students in their study evaluated both positively, however the major focus of the researchers was blended learning per se, and their study concentrated mainly on the use of concept maps. The use of videos was evaluated positively however, in terms of their ability to embed anatomy and physiology into the reality of nursing care, adding a level of authenticity, a finding apparent in the systematic review by Noetel et al. (2021).

The term “flipped classroom” is arguably an umbrella term for any teaching activity that rejects a traditional lecture or “chalk and talk” approach. As Abeysekera & Dawson (2015) contend, while extensively researched and ubiquitous in education literature there is no clear agreed definition of what constitutes a “flipped classroom” although they accept that methods labelled thus can reduce cognitive load and increase student motivation. Steen-Uthein & Foldnes (2018) propose that concepts that encompass the theory of the “flipped classroom” are the antithesis of traditional methods which are merely transmission and encourage passivity. Steen-Uthein & Foldnes (2018) further state that such concepts foster pre-class preparation and use student-focused exercises and activities to increase student preparation. Logically, any classroom activity that encourages student participation would satisfy this definition and is arguably typical of modern teaching (Persky & McLaughlin, 2014). Nonetheless, concepts of the “flipped classroom” are increasingly popular in nurse education literature (Betihavas et al., 2016).

Several authors have investigated its use in the teaching of the biosciences (Branney & Priego-Hernandez, 2018; Bingen et al., 2020; Joseph et al., 2021; Musni et al., 2021). However, evidence of its efficacy has yet to be fully defined and articulated. Recent research into the use of “flipped classroom” concepts tend to highlight enhanced student satisfaction as their main advantage over traditional teaching methods. However, Joseph et al. (2021) and Musni et al. (2021) suggest that this pedagogical theory can enhance understanding and appreciation of the biosciences. Joseph et al. (2021) contend that the knowledge and understanding of the respiratory system was enhanced in students subject to “flipped classroom” techniques. In pre and post-test exam questions students that attended “flipped classroom” sessions outperformed those that were taught with traditional methodologies. However, it is noteworthy that the students performed equally well on other aspects of their bioscience learning. Musni et al. (2021) argue that using “flipped classroom” approaches resulted in a deeper level of understanding of physiological concepts in their students. Analysis of student produced concept maps, Musni et al. (2021) contend, suggested a higher-level of thinking in those students subject to “flipped classroom” approaches. Higher-level thinking being defined as evidence of inference and questioning absent information as opposed to verbatim expression of information from textbooks.

It is clear from recent research that students evaluate “flipped classroom” approaches positively. Branney & Priego-Hernandez. (2018) found that 92% of the 167 students that responded to their questionnaire expressed a higher level of satisfaction with “flipped classroom” techniques than traditional methods and 76% expressed a preference for them. Branney & Priego-Hernandez. (2018) do accept, however, that 21% preferred traditional lectures. Joseph et al. (2021) uncovered

reasons for this preference and satisfaction. Their questionnaire data suggests that students' regard for "flipped classroom" approaches relate to making bioscience more interesting, enhancement of learning, enhancement of academic performance (increase in grades), and being more attentive in class. However, research by Bingen et al. (2018) proposed that for many students "flipped classroom" techniques were problematic. Students felt discussing bioscience with peers broke down fears of ignorance because the discourse highlighted a shared lack of progress. Many students also felt that the socialisation imposed by classroom activities enhanced their learning. However, Bingen et al (2018) also describe a tension between the "flipped classroom" philosophy and their student's expectations. While some thrived on the self-directed approach others felt the lack of teacher-centred approach isolating as they struggled to keep pace with their peers.

There are multiple definitions of what constitutes virtual reality in an education setting. Common adjectives include digital, immersive, and three-dimensional. Fabris et al. (2019:69) encapsulate what is virtual reality as "an interactive experience wherein one can become immersed within a computer-generated environment". While not a recent technology, use of virtual reality has become increasingly popular in higher education in recent years, with enhancing motivation and collaboration being major drivers in an initiative often referred to as gamification (Kavanagh et al., 2017). Nursing is no exception, and virtual reality is becoming increasingly popular in nursing education provision around the world (Choi et al., 2022). Recent research into using virtual reality to teach bioscience promotes its use through its ability foster enthusiasm for their chosen topic in their students. There is sense that students enjoy using the virtual reality software, which in turn ensures students enjoy and have fun while learning. Any benefits, therefore, are a

biproduct of their enthusiasm, rendering enhancement of learning and patient care difficult. Indeed, none of the three most recent studies provide tangible evidence of enhanced learning. Thompson et al. (2020) used quantitative data to establish the efficacy of virtual reality to teach the application of anatomy and physiology to nursing assessment. The quantitative data indicates that students enjoyed this teaching method with 93% stating it was easier to learn anatomy and physiology using virtual reality and 78% claiming it enabled them to make clearer links between underlying bioscience and their patient assessments. Although only 46 students completed their questionnaire. Semi-structured interviews and focus groups provided Saab et al. (2021) with deeper insight into why students enjoy and relish the opportunity to use virtual reality. Their analysis highlighted that using virtual reality provided a safe space for trial and error, to problem solve, and ultimately make mistakes, a luxury not afforded by clinical practice when caring for real people. This study focused on the use of virtual reality in nurse education generally but interestingly Saab et al. (2021) single out anatomy and physiology for special attention claiming that virtual reality enables contextual transfer by allowing students to visualise the human body and its organs. This view is reflected in questionnaire data collected by Downer et al. (2019) who used virtual reality to teach midwifery students. Their research indicated that allowing their students to engage in virtual environment enhanced their understanding of the anatomy of the uterus.

In conclusion, analysis of the efficacy of student-centred learning approaches to enhance bioscience learning is arguably equivocal. This corresponds with the assertions of Evensen et al. (2020) who contend that a principal approach has yet to be established. Their analysis of student engagement and motivation in learning bioscience post the introduction of student-centred learning techniques found that no

single teaching strategy is currently recommended above others. While a panacea has yet to be established there remains an opportunity for further research specifically exploring the use of student-centred approaches with specific reference to alleviating the burden of studying bioscience for nursing practice.

7.4 Authentic assessment

The students in this study believed that the content of their bioscience classroom sessions lacked authenticity. As discussed in Chapter 6, students felt that taught content was unrelatable to the reality of clinical practice. Recent research also suggests that these views are universal indicating that students consider there to be a disconnect between what is taught and what is required in practice (Davies, 2010; Craft et al., 2016; Barton et al., 2021).

In a nurse education context, the term authenticity is associated with simulation exercises in which students role play, often with interactive teaching resources and equipment, such as defibrillators, blood pressure monitoring equipment, and electrocardiograms. The use of simulation is associated with closer links between theory and practice that allow students to reconcile what they have learnt in the classroom and their clinical experiences (Cant & Cooper, 2017). However, there is a lack of evidence of the effectiveness of simulation in the teaching of the biosciences, which questions the use of simulation to provide the connections students' desire. Bland et al. (2017) explain that while simulation provides a degree of realism with its use of contemporary medical equipment and sophisticated lifelike mannikins and dolls, use of such equipment does not necessarily equate with authenticity. In an education sense authenticity is the provision of context within which student can use their acquired knowledge. In other words, it's how students

are asked to apply their knowledge that is paramount. Craft & Ainscough (2015) and Bayley (2023) suggest the answer to this conundrum lies in the use of authentic assessments to assess bioscience knowledge. Authentic assessments have been defined as assessments in which students not only demonstrate knowledge acquisition but also transference to clinical skills and practice (Poindexter et al., 2015). Student understanding of the biosciences is traditionally assessed via exams (often multiple choice) or via essay questions based on case studies. For advocates of authentic assessment, the argument is that completing exams or drafting essays are not nursing skills (Bland et al., 2017; Cant & Cooper, 2017; Craft & Ainscough, 2015). In authentic assessment students are asked to complete real-life tasks that are analogous to their clinical work and reliant on the biosciences (Bayley, 2023). Examples include, making a nursing diagnosis, problem-solving, managing and escalating a deteriorating patient, and referring a patient to another member of the multi-disciplinary team.

Advocates of authentic assessment highlight many advantages. Craft & Ainscough (2015), for example, argue that authentic assessments move learning beyond merely achieving grades or passing exams, focussing on the attainment of useful professional knowledge, a view echoed by Poindexter et al. (2015) who contend that authentic assessments have greater intrinsic value because they are based on legitimate professional work. Craft & Ainscough (2015) also argue that if one accepts the view that all students are assessment rather than knowledge acquisition driven, authentic assessment can lead to vicarious learning of essential bioscience topics even if students revise and learn just enough to pass their assessment. Poindexter et al. (2015) recommend authentic assessment because in their view it promotes meaningful thinking and transference of knowledge into

complex clinical issues. This assertion has merit as Sokhanvar et al. (2021) in their systematic review found that enhanced critical thinking and problem-solving skills were a constant feature of studies into authentic nursing assessment. Sokhanvar et al. (2021) also found that authentic assessment improved student satisfaction, advanced engagement, enhanced communication, promoted collaboration, increased confidence, and fostered reflection and self-assessment.

Despite the wealth of literature on authentic assessment in nursing and the wider higher education community there is little evidence of its effectiveness in nursing. As Bayley (2023) contends, despite evidence that student nurses value this approach and the clear advantages highlighted above, there remains little evidence of a tangible effect on students' academic success, in terms of knowledge to enhance practice or assessment grades. Nevertheless, as this section has argued, authentic assessments have a theoretical basis and therefore, future research should focus on its utilisation to enhance the learning of biosciences in student nurses, particularly its potential for increasing the visibility of the biosciences in curricula and reducing the burden of learning.

7.5 Enhanced working relationships between university-based tutors and practice-based nurses.

Analysis of the focus group data suggests that there is a demarcation between education and clinical practice. While educationalists would argue that theory informs practice, from a student perspective they are separate worlds. Students not only view classrooms and clinical placements discretely, but they also feel there is little evidence of a symbiotic relationship between the two in terms of bioscience (see chapters 5 and 6). This suggests that any solution to the value and

reality of clinical practice paradox would need an effective bipartisan approach. However, there is a historical schism between education and clinical practice in nursing (Greenway et al., 2019). Therefore, any workable solution must also recognise the historical and cultural differences between theory and nursing practice.

The partition between universities and health providers is often referred to as the theory-practice gap, a subject endemic in nursing literature, with academics addressing how the gap could be bridged, fixed, or negotiated. However, defining this gap has proved controversial with little agreement on what constitutes this divide or how it could be breached. Greenway et al. (2019), for example, refer to the theory-practice gap as a metaphorical void in which a gap is experienced and yet its components remain unidentified. There is some agreement, however, on the root cause of the theory practice gap. As discussed in Chapter 3, my nursing journey coincided with nurse education's move into higher education, an initiative entitled "Project 2000". As Bourneuf & Haight (2010) and O'Driscoll et al. (2010) contend, theories of theory-practice gaps stem from the separation of nurse education away from teaching hospitals. While this was arguably to enhance nursing's academic currency and therefore its professional standing, it also created a physical barrier, in terms of location, culture and priorities, between those that taught and those that cared for people. For example, nursing's pursuit of academia was viewed by those working on frontline health services to be at the expense of clinical skills leading to a skill depleted workforce, which further exacerbated the separation of education and practice. While there was little evidence for this (Bourneuf & Haigh, 2010), the United Kingdom Central Council (UKCC) did call for greater integration between academia and practice and a greater emphasis on skills in 1999 (Bradshaw, 2000). Subsequent inquiries also exposed gaps between theory and practice and identified

them as problematic. The Willis Report on nursing education, for instance, identified discrepancies between theory and practice that were detrimental to patient care (Willis, 2015). Likewise, the Francis Report into inefficiencies in patient care in Mid Staffordshire recommended greater links between theory and practice in terms of skills and compassion (Mid Staffordshire NHS Foundation Trust Public Enquiry, 2013). These tensions between theory and practice, argue Leonard et al. (2016), manifest because of a lack of a bipartisan approach as nurse education is managed by two separate communities that are distinct from one another. Cardwell et al. (2019a:4153) argue that these divisions remain as strong today as they did in the nineties, referring to “the good old days”, a nostalgic and possible romantic notion that describes a time before academia intervened in nurse education, a time when “real nurses” trained and produced “real nurses” but as Cardwell et al. (2019a) argue this perspective remains inaccurate as the positive impact of education on patient care is indisputable (Audet et al., 2018; Mahfoud et al., 2018). In essence, this aspect of the theory practice gap is informed by what Cardwell et al. (2019b) refer to as a physical and intellectual gulf between what occurs in the reality of clinical practice and academia. Nurses provide physical “hands on” care whereas academics do the thinking. Division stems from how they perceive one another. Academics believe that practicing nurses lack intellectual integrity, and clinical nurses feel that academics lack practical credibility. While both sides of this division exacerbate theory-practice relationships, Cardwell et al. (2019a:4153) suggest that clinical nurses harbour the lion’s share of negativity as the following quote from an overheard conversation between nurses encapsulates “..the problem with academics is they have no idea about the realities of the clinical environment, how can they get students work ready when they haven’t even set foot in a hospital for years? They’re

not clinically competent." This perspective was also apparent in the focus group data. Indeed, this group of students questioned the clinical credibility of tutors and identified their attitude towards clinical work as a contributory factor in their struggles with the biosciences (see Chapter 6).

Analysis of the focus group data suggested that for this group of students some clinical and education colleagues were held in low esteem. This is a commonly held view and perceptions of low credibility or kudos in tutors and clinicians acts as a barrier to learning in clinical practice and reinforces the perceived theory-practice gap, thus hindering the learning and teaching of the biosciences (Koch et al., 2020). As Ousey & Gallagher (2010) argue, unlike other professions, in nursing, the term clinical is synonymous with "hands on" nursing care, something that students do not witness their nurse tutors doing. The university tutor's role in clinical practice has been historically controversial (Cardwell, 2020) but from a university perspective the function of the tutor in clinical practice is clear, in that their role is to fuse theory and practice together by facilitating the connection between theory and "hands on" nursing care. However, historically this aim is not reinforced with attendance, with practicing nurses spending less than 1% of their time with visiting nurse tutors (Lloyd Jones et al., 2001). Consequently, Price et al. (2011) argued, the lack of tutor presence in clinical practice ensures the impact of nurse tutors in clinical practice is negligible. Their questionnaire data, for example, highlighted that nursing tutors were considered visitors to clinical areas rather than fellow professionals and that their attendance was to advise students on their academic assignments rather than to explore connections between theory and practice.

Conversely, while tutors are seen to lack clinical credibility, clinical nurses are considered unable to teach the bioscience or in some instance, lack sufficient understanding of them. This perspective was apparent in the focus group data, but it also remains a popular concept among the wider student nurse population. As Fell et al. (2016) discovered, nursing student nurse felt that the importance and relevance of bioscience to nursing care was not reflected in the nurses they worked with, with bioscience often being shelved for other aspects of care. In mitigation, as Molesworth & Lewitt (2015) contend, the high workload associated with nursing care ensures little time for tangible teaching. The chaos and high volume of work aside, students identify a deficit in the quality of knowledge and understanding of the biosciences between nurse teachers and clinical nurses (Koch et al., 2020).

Arguably, this is a historic issue which has led to nurse tutors revisiting and redefining what they mean by clinical credibility. Cardwell et al. (2020) for instance, argues that the notion that nurse tutors need to be clinically credible stems from a now outdated regulation that nurse tutors spend 20% of their time liaising and engaging with clinical practice. Furthermore, Cardwell et al. (2019a) highlight that there is no clear definition of what constitutes clinical credibility and that the need for clinicals to be clinically credible is questionable. As Ousey and Gallagher (2011:665) state “Nursing is a broad professional church, and all nurses should eschew professional parochialism and value each other’s contribution to the totality that is nursing”. Criticising one role for a lack of credibility in another role is therefore arguably a distraction. As Ousey and Gallagher (2010) further argue criticising nurse tutors for lacking clinical credibility is akin to criticising a practicing nurse for being unable to conduct a lecture. Given that the student perspective considers nurse tutors deficient in clinical credibility, a possible solution to this issue is to first redefine

clinical credibility so that it recognises the value of the nurse tutor's educational contribution to the profession of nursing.

In summary, closer working relationships between university-based tutors and clinical staff are recommended as a solution to the value and reality of clinical practice paradox (Manchester & Roberts, 2025). While this is arguably self-evident there is a wealth of literature confirming that the relationship between theory and practice is dysfunctional. Furthermore, the causes of this ineffectual relationship are manifold and entrenched in both education and practice. If the premise that enhanced relationships between education and practice will enhance the students learning of the bioscience is accepted, then it would be incumbent to investigate how tutors and clinicians can overcome historic tensions and work collegiately to ensure students feel more able to discuss and learn bioscience in clinical practice alongside their qualified colleagues.

7.6 Chapter summary.

This chapter identified two major limitations of this research, namely that the data focussed solely on adult-field nursing students studying a discontinued curriculum based on out-of-date standards. Repeating the questionnaire and focus groups with a sample that includes child-, learning disability-, and mental health-field students following a programme based on the current standards could in counteract these limitations, strengthen the findings of the thesis, and provide insight into the perspectives of students hitherto relatively ignored (i.e., mental health and learning disability nurses). The chapter also explored the potential for further pedagogical research into student-centred approaches and authentic assessment as the potential solutions to the value and discomfort paradox. This chapter also recommended

ways to create symbiotic bipartisan approaches to bioscience education in clinical practice could counter the value and reality of clinical practice paradox and enhance the student learning experience.

Chapter 8

Conclusions

This concluding chapter summarises the thesis and restates and validates its findings. This is a reflexive thesis and therefore it is also fitting to add some final reflections that encapsulate how this research has informed my professional perspectives and how it will influence future research and teaching. In essence, this chapter will outline two key biproducts of the research, which have had a significant impact on how I view the learning of the biosciences and my working relationships with student nurses. Firstly, the realisation that historical dysfunctional relationships between academics and clinical colleagues have a significant impact on student learning of the bioscience was an unexpected revelation. While on reflection the divisions between classrooms and practice were obvious, they nevertheless did not inform or inspire the thesis. Secondly, the successful use of unsupervised focus groups has been emboldening and will be considered in all future student evaluations and nurse education research. This chapter analyses the relevance of both unexpected biproducts for nurse education.

8.1 Final reflections.

This is a reflexive thesis and therefore it is prudent to summarise my reflections on its completion. This thesis describes a journey from personal professional observations through to a thesis that includes an interpretation of contemporary students' views on their learning that will inform how we teach bioscience and how we work with students in practice. The foundations of this study were built over many years, and based on my experiences as a learner, a practicing

staff nurse, and as a teacher. What started with an inkling that something was amiss has grown into a completed thesis that explains what I now consider a genuine phenomenon that impacts on student learning. The “bioscience problem” has been an ever-present discussion in the nursing literature and one that has dominated my academic journey from my earliest days as a novice tutor through to an experienced lecturer of 22 years. As a nascent tutor, the incongruences and seemingly ineffective teaching of the biosciences were apparent and yet not easy articulated. The nebulous nature of the noticeable problems with teaching were reflected in the research I read. Completing this thesis facilitated a rigorous academic processing of the literature, allowing me to deconstruct the “bioscience problem,” which is arguably a rather nebulous construct and re-assemble it as a set of themes, which provided a much clearer understanding of its complexities. Critically reviewing the extensive literature on the problematic nature of bioscience education also served to confirm my viewpoint, based on firsthand experiences, that the learning and teaching of the biosciences was flawed, in that students do find bioscience neglected in curricula, too complex, and anxiety inducing. However, I was equally cognisant that this body was increasingly historic, based on out-dated curricula, and conducted outside of the UK. My personal conclusion is, therefore, that conducting this research, despite its limitations, was worthwhile in that it provides evidence that my concerns are also reflected in the data this thesis analysed. This provides me with the confidence to address the issue and engage university and practice-based educators in conversations about bioscience and how we can enhance learning.

I was concerned that the discourse exploring the bioscience problem had a heavy focus on teaching and the opinions and insights of teachers. While students’ views were sought, data was almost entirely quantitative, with little qualitative insight

into their perspectives. In the absence of a solid student perspective lacking, I was filling a key gap in our understanding of the learning of the biosciences. This was compelling and uncovered a hitherto unheard perspective, which illuminated issues not previously discussed in the nursing literature. The net result being I now have data that informs nurse education from a unique viewpoint. This exercise was not only the pursuit of a qualitative perspective but also an exercise in humanism and liberty. In choosing unsupervised focus groups I was able treat the students with respect and allow them to freely express themselves through naturalistic conversations. I believe, therefore, that this thesis explored learning through a student nurse lens and the data I uncovered is an unencumbered insight into their reality, written in their own words, and free from tutor interference. My conclusion is that this using the unsupervised focus groups and naturalistic conversations is a more authentic and sensitive way of accessing the student voice. This is stark contrast the traditional use of the student voice which is centred on quality control or university self-interest which is arguably disingenuous. On conclusion of this thesis, I am pleased that I was able to execute a research project that was informed by my humanist values and paid close attention to key personal philosophical codes, such as the interlinked concepts of unconditional positive regard and empathy. By allowing students to discuss whatever they thought was relevant to them I treated them as equal partners in pursuit of the true student learning experience.

Finally, on conclusion of this research I would argue that this thesis is more than its final findings. It has provided insight into the students' experiences of learning and a platform for future research, be that repeating the questionnaires and focus groups or investigating teaching methodology and tutor and practitioner relationships. In chapter 7 I explored key routes for research and identified

pedagogical approaches that could enhance the learning and teaching of bioscience in classroom settings. However, there are two further key issues that this project has highlighted that have impacted on how I view my work with students. Firstly, the unexpected realisation that my contributions to the historic ineffective education links between academics and clinical colleagues will have had a significant impact on student learning of the bioscience. Secondly, the hoped-for success in utilising unsupervised focus groups has inspired me to consider using them in future student evaluations and nurse education research. The remainder of this chapter will reflect on the relevance of both concepts.

8.2 Facing the theory-practice gap.

While analysing the qualitative data from the focus groups it became abundantly clear that students were deeply unsatisfied with their learning experience in clinical practice. When investigating the causes and influences of this dissatisfaction it became clear they relate to a dysfunctional relationship between academia and clinical practice. Arguably there are multiple causes for this historic schism, but analysis of the literature highlighted that solutions lay in enhancing this ineffective relationship. While investigating the tensions between clinical practice and academia I recognised many of the central issues and felt that the literature reflected in my professional experiences. There is a clear demarcation between universities and practice areas and in my experience, nursing's pursuit of academia is viewed by nurses as being a cause of skill depleted workforce (Bourneuf & Haigh, 2010). My view corresponds with Cardwell et al. (2019b) who believes there is a physical as well as intellectual gulf between clinical practice and teaching and that these differences stem from how they perceive each another. On reflection I also

concur with Koch et al. (2020) who argue that this relates to credibility. From a clinician's perspective tutors lack clinical credibility whereas tutors consider clinicians lacking intellectual capability. The students who took part in this study clearly subscribed to both views. I conclude, therefore, that we need to redefine what nursing means by clinical credibility. As highlighted in Chapter 7, the totality of nursing encompasses both clinical practice and teaching and criticising one role for a lack of credibility in another is nonsensical (Ousey and Gallagher, 2010). An unexpected positive, therefore, of completing this research project was the forging of a new avenue of interest. I now recognise that enhancing the understanding of the biosciences in qualifying nurses is not solely dependent on enhancing what happens in classrooms. It also involves investigating how tutors and clinicians can overcome historic tensions and work collegiately in the pursuit of enhanced bioscience learning.

8.3 Promoting the unencumbered student nurse voice.

While listening to the student voice is considered intrinsically good, the student voice remains a much-maligned term, with consensus being that when authors use the term student voice, they have rarely asked the students anything of tangible value (Adam et al., 2014). This is because, as discussed in Chapter 3, the term student voice is synonymous with the collection of student feedback, sought not to illuminate the students' lived experiences, but as a quality control exercise. This suggests that claims of student engagement are viewed as tokenistic rather than genuine attempts to strengthen tutor-student relationships (Mendes & Hammett, 2023), and as such are condescending, demeaning, and ultimately benign (Cook-Sather, 2006).

However, I would argue that my humanistic approach, which allowed students to speak freely, ensured that I accessed the genuine student voice. The resulting data is authentic and the analysis a faithful reflection of their learning experiences. This was achievable because the freedom to speak without direction or interference fostered trust in me as a researcher. In the aftermath of data collection and analysis I concluded that using unsupervised methods of data collection provide a means by which we can ascertain the true feelings of our learners, which would provide rich seams of data that can be used to enhance curriculum. As Adam et al. (2014) and Cook-Sather (2006) argue students should be viewed as experts in their own learning and therefore should be included in research and curriculum development. Therefore, seeking a more accurate reflection of insight through the unencumbered student voice can only enhance our research and our work with learners.

However, there is a widespread reluctance to seek out the student's perspectives of their learning as accessing the genuine student voice is a challenge that educators do not relish (Lindquist, 2010). There is a nervousness in tutors who feel vulnerable to negative feedback and a cultural reluctance to dismantle teacher-pupil hierarchies to facilitate freedom of expression. Bergmark & Westman (2016), for example, argue that students learn within traditional frameworks of education in which both students and teachers feel protected. Allowing students the freedom to express themselves will deconstruct this natural order, which could trigger and emotional responses in both tutors and learners as they come to terms with a less asymmetrical teacher/pupil relationship. This emotional response, Bergmark & Westman (2016) contend, has a negative impact on learning. Unconditional positive regard can be viewed as problematic. Tutors often feel reluctant to blindly accept all student views irrespective of credibility and with little opportunity for redress, there is

a risk that pedagogical decisions could be based on unfettered student opinion which is inappropriate (Cook-Sather, 2016; 2020). Analogous to unchallenged criticisms is the inconvenient truth that tutors may feel uncomfortable asking for criticism because they may not like what they hear (Cook-Sather, 2006). A phenomenon that Adam et al. (2014) attribute a culture of mistrust in the students' perspectives that permeates the teaching profession. However, as Cook-Sather (2014) argue, seeking the true student voice will inevitably deconstruct traditional teaching hierarchies and should be embraced rather than dismissed as too troublesome or problematic. This research has shown that allowing freedom of expression provides access to the hitherto unheard and a richer dataset and therefore hopefully encourage other nurse educationalists to embrace unsupervised methodologies. This will mean, however, that tutors will have to accept that traditional tutor-learner relationships will be deconstructed, and that researchers and teachers may receive criticisms they are reluctant to hear. Nevertheless, the net result will be a truer reflection of how students think and feel about their learning.

8.4 Summary.

The inspiration for this thesis was the widely discussed phenomenon referred to as "the bioscience problem," which broadly stated that the teaching and learning of bioscience in nurse education is flawed. I was engaged by the "bioscience problem" concept as many of the issues it raised corresponded with my experiences as student nurse, practising nurse, and nurse tutor, which led me to question the extent to which bioscience education remains problematic for modern students and speculate on what constituted the learning experience of the students I worked with.

An analysis of literature published between 1991 and 2023 suggested that a "bioscience problem" still exists and that the teaching of bioscience in nursing is flawed and leads to nurses qualifying with an inadequate understanding of biology, physiology, and pharmacology (McVicar et al., 2010; Craft et al., 2016; Fell et al., 2016; Gordon et al., 2017). Furthermore, there is evidence that phenomena I witness in the students I teach are reflected in the literature, for example feelings of anxiety related to learning bioscience (Nicoll & Butler, 1996; Jordan et al., 1999; Clancy et al., 2000; McKee, 2002; Gresty & Cotton, 2003; Andrew et al., 2008; Craft et al., 2013; Mortimer-Jones et al., 2018), perceiving learning bioscience to be too complex and difficult to master (Caon & Treagust, 1993, Chapple et al., 1993, Craft et al., 2016; Gordon et al., 2017), and that more a lack of classroom time dedicated to the biosciences could alleviate their anxieties (Nicol & Butler, 1996; Jordan et al., 1999; Friedal & Treagust, 2005; Davis, 2010).

However, much of the research that validates the "bioscience problem" is historic and conducted overseas. Furthermore, there has been a distinct lack of qualitative research exploring the experiences of those learning the biosciences. Almost half of the research discussed in Chapter 2 relied solely on data gathered from questionnaires or surveys. The remaining qualitative studies contained little evidence of in-depth analysis of the student's experiences. Therefore, given the claims within the literature were historical and not exclusive to the UK and given there was a lack of a qualitative insight into the perspectives and experiences of modern UK nursing students this thesis posed two questions:

1) To what extent do the biosciences remain a cause for concern among contemporary adult-field nursing students completing a BSc (Hons) Nursing programme?

2) What are the perspectives and experiences of modern adult-field nursing students in relation to their learning of the biosciences?

A combination of both inductive and deductive reasoning was required to answer both research questions and a mixed-methods approach using quantitative data to answer question 1 and qualitative data to answer question 2 was pragmatic and effective. The use of questionnaires for to answer question 1 was an effective and efficient way to assess the students' level of concern regarding their learning of bioscience. While producing superficial and unsophisticated data the questionnaires nonetheless established a diagnosis of a problem, which was essentially the aim of the initial stages of the research. The diagnosis highlighted by the quantitative data was that for this group of student nurses, bioscience when compared to social science and nursing theory was more likely to cause anxiety, more likely to be perceived to be more complex, warranted the most classroom time, and was deemed the most valuable in terms of nursing care. A finding that corresponded with personal experience and the literature, therefore answering research question 1. Having established that the biosciences remained a concern for a group of contemporary students meant that further investigations into the perspectives of students learning bioscience was justified.

Using an interpretivist phenomenological approach facilitated a deep exploration of the student experience, as opposed to a description of their realities, which would not have fully answered research question 2. The findings of the qualitative phase of this thesis were also reinforced by the methods of data collection, which were influenced by humanistic principles, such as unconditional positive regard, and focussed on the unencumbered student voice. In this

unsupervised forum the students described their learning experiences from 6 perspectives, namely:

Concept1: *Indispensability* – the truism that an understanding of the biosciences is a prerequisite for safe and effective nursing care.

Concept 2: *Deficiency* – the perception that the provision of bioscience in the curriculum is deficient in that it does not meet their expectations.

Concept 3: *Burden* - the perception that learning the biosciences is burdensome and arduous, and that the amount of knowledge required is insurmountable.

Concept 4: *Angst* – the belief that learning and using bioscience causes anxiety and stress.

Concept 5: *Reality* - the notion that learning bioscience in the reality of clinical practice is problematic and can adversely affect their understanding.

Concept 6: *Identity* – students assume different identities depending on their situation. These assumed identities impact on their learning of the biosciences.

Because these findings come from unsupervised focus groups in which students freely expressed their opinions and feelings through natural conversations, they represent the students' truth as they see it. Therefore, these findings have merit and should be used to inform changes to education, research, and curriculum development.

The finding that students place a high value on the biosciences and their relevance for nursing practice is key. This high value produces two paradoxes or tensions which explain the anxieties expressed by students in terms of their learning of the biosciences. There is a "value and discomfort" paradox in that the value students place on bioscience is tempered by the discomfort they experience when

learning them. There is also a “value and reality of clinical practice” paradox in that the value of bioscience is hampered by the reality of working in front-line health services. The qualitative data highlights that both negatively impact on the students’ ability to learn the biosciences.

If nurse educators are to counteract the influence of these two paradoxes future research should focus on pedagogical solutions that address learning in both classroom and practice settings. Solving the value and discomfort paradox, for example, could include promoting blended or active learning, and the pursuit of authentic bioscience assessment. Addressing the value and reality of clinical practice paradox will require stronger links between academics and clinical staff. Therefore, future work should focus on why bipartisan working has traditionally impeded bioscience learning. On completion of this thesis, it is also clear that some of the limitations of the research provide opportunities for future research that could strengthen the findings of this thesis. Repeating the questionnaire and focus groups with a wider student nurse population that includes those studying mental health, children’s, and learning disability nursing would provide further evidence on students with different needs and foci, it could also validate and bolster the notion that student nurses remain anxious about the biosciences and that the value they place on them is hampered by both classroom and practice experiences.

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Appendix 1

Questionnaire used in the pilot study.

An exploration of the strategies utilised by student nurses to manage their learning of bioscience within the BSc (Hons) Nursing programme: implications for the teaching of bioscience subject matter in modern nursing curricula.

Researcher: Anthony Wheeldon

Student Questionnaire

Many thanks for agreeing to complete this short two-part questionnaire. It will take you approximately 5 - 10 minutes to complete.

The first part consists of a series of questions that ask you to rank the following theoretical classroom based subject areas in order of relevance to you.

Nursing Theory

Bioscience

Social Science

Below is a list of examples of topics for each subject area and typical modules where they are taught.

Subject Area	Examples of topics	Typical Modules
Nursing Theory	Nature and Ethics of the Profession General Principles of Health and Nursing	Professional Aspects of Care The Healthy Adult Patient Centred Care 1 Patient Centred Care 2 Transitions to Professional Practice
Bioscience	Anatomy Physiology Pathophysiology Microbiology Pharmacology	Biological Basis of Health and Wellbeing Holistic Care of the Acutely Ill Adult Advanced Nursing Care of the Adult Patient
Social Science	Sociology Psychology Social and Health Legislation Legal Aspects of Nursing	Professional Aspects of Care The Healthy Adult Nursing Adults with Long Term Conditions

		Health Promotion

The second part of the questionnaire consists of one closed answered and one open ended question, which seek to establish your views on one issue relating to student learning.

Please note that your answers are completely confidential. Please do not put your name on this form.

Part One

Each question in this section relates to a different issue. For each question rank the topic areas in order of relevance to you. Below is an example, which demonstrates how to complete each question.

Interest

Rank all the following topic areas in terms of interest. For example, rank the subject area you find most interesting as 1 and the subject area you find least interesting as 3.

Bioscience ___2___

Nursing Theory __1__

Social Science __3__

As you can see the above student finds Nursing Theory the most interesting, Bioscience the second most interesting and Social Science the least interesting.

Please complete the following 5 questions in the same manner

Question 1 – Anxiety

Rank all the following subject areas in terms of anxiety. For example, rank the subject area that you feel causes you the most anxiety as 1 and the subject area that causes you the least anxiety as 3.

Nursing Theory _____

Social Science _____

Bioscience _____

Question 2 – Difficulty

Rank all the following subject areas in terms of difficulty. For example, rank the subject area that you find most difficult to understand as 1 and the subject area that you find easiest to understand as 3.

Bioscience _____

Nursing Theory _____

Social Science _____

Question 3 – Professional Value

Rank all the following subject areas in terms of professional value. For example, rank the subject area that you feel has the greatest value to your professional development as 1 and the subject area that you feel has the least value to your professional development as 3.

Social Science _____

Bioscience _____

Nursing Theory _____

Question 4 – Patient Care

Rank all the following subject areas in terms of their impact on your patient care. For example, rank the subject area that you feel most informs your patient care decisions as 1 and the subject area that you feel has the least influence on your patient care decisions as 3.

Nursing Theory _____

Social Science _____

Bioscience _____

Question 5 – Classroom Time

Rank all the following subject areas in terms of ideal classroom time. Imagine you could determine the amount of time tutors spend teaching the following subject areas. Rank the subject area that you feel requires the most classroom time as 1 and the subject area that you feel requires the least classroom time as 3.

Bioscience _____

Nursing Theory _____

Social Science _____

Part Two

Question 1

In relation to question 1 in part 1, which subject do you feel causes you the most anxiety? Please tick.

Social Science _____

Bioscience _____

Nursing Theory _____

Question 2

Please give the reasons why you ranked the above subject area as most likely to cause you anxiety.

Many thanks for taking time to complete my questionnaire.

Anthony Wheeldon RN, MSc, PGDip, BSc

(Professional Doctorate in Education student)

Appendix 2

Questionnaire used in the quantitative phase of the study.

A mixed methods exploration of student nurses' experiences and perspectives of their learning of bioscience on a contemporary nursing degree programme**.**

Researcher: Anthony Wheeldon

Student Questionnaire

Many thanks for agreeing to complete this short two-part questionnaire. It will take you approximately 5 - 10 minutes to complete it.

The first part consists of three questions that ask you about the following three subject areas.

Nursing Theory

Bioscience

Social Science

To aid you, the table below lists examples of nursing topics for each subject area and the modules where they are normally taught.

Subject Area	Examples of topics	Typical Modules
Nursing Theory	Nature and Ethics of the Profession General Principles of Health and Nursing	Professional Aspects of Care The Healthy Adult Patient Centred Care 1 Patient Centred Care 2 Nursing Adults with Long Term Conditions Transitions to Professional Practice
Bioscience	Anatomy Physiology Pathophysiology Microbiology Pharmacology	Biological Basis of Health and Wellbeing Holistic Care of the Acutely Ill Adult Advanced Nursing Care of the Adult Patient
Social Science	Sociology Psychology Social and Health Legislation Legal Aspects of Nursing	Professional Aspects of Care The Healthy Adult Nursing Adults with Long Term Conditions Health Promotion

The second part of the questionnaire asks for demographical information. Please answer all these questions honestly.

Please note that your answers are completely confidential. Please do not put your name on this form.

Part One

This section contains 5 questions.

The first three questions ask you to rate Nursing Theory, Bioscience and Social Science in relation to anxiety, difficulty and complexity and classroom time. Questions 4 and 5 will ask you to indicate the extent to which you agree or disagree with a series of statements.

Below is an example that demonstrates how to complete questions 1, 2 and 3.

Interest

Rank all the following topic areas in terms of interest. For example, rank the subject area you find most interesting as 1 and the subject area you find least interesting as 3.

Bioscience ___2___

Nursing Theory __1__

Social Science __3__

I find none of the above interesting ___

As you can see the above student finds Nursing Theory the most interesting, Bioscience the second most interesting and Social Science the least interesting.

Please complete the following 3 questions in the same manner

Question 1 – Anxiety

Rank all the following subject areas in terms of **anxiety**. For example, rank the subject area that you feel causes you the most anxiety as 1 and the subject area that causes you the least anxiety as 3. If none cause you any anxiety, please indicate this with a tick.

Nursing Theory _____

Social Science _____

Bioscience _____

None of these subject areas cause me anxiety _____

Question 2 – Difficulty and complexity

Rank all the following subject areas in terms of **difficulty**. For example, rank the subject area that you find most difficult to understand as 1 and the subject area that you find easiest to understand as 3.

Bioscience _____

Nursing Theory _____

Social Science _____

Question 3 – Classroom Time

Rank all the following subject areas in terms of ideal classroom time. Imagine you could determine the amount of time tutors spend teaching the following subject areas. Rank the subject area that you feel requires the most classroom time as 1 and the subject area that you feel requires the least classroom time as 3.

Bioscience _____

Nursing Theory _____

Social Science _____

Questions 4 and 5 will ask you to indicate the extent to which you agree or disagree with a series of statements.

Question 4

Please state the extent to which you agree or disagree with the following statements by ticking the relevant box.

"Learning the biosciences (anatomy, physiology, pathophysiology, microbiology, pharmacology) is an important part of a nurse's education."

Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree

"Learning nursing theory is an important part of a nurse's education."

Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree

“Learning the social sciences (sociology, psychology, social and health legislation, legal aspects of nursing) is an important part of a nurse’s education.”

Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree

Question 5

Please state the extent to which you agree or disagree with the following statements by ticking the relevant box.

“Patient care can be enhanced if nurses have a good understanding of the physiology and pathophysiology pertinent to the patient’s past medical history and current state of health.”

Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree

“Patient care can be enhanced if nurses have a good understanding of the general principles of health and the nature and ethics of their profession.”

Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree

“Patient care can be enhanced if nurses have a good understanding of social, psychological and legal aspects of health.”

Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree

Part Two

Please answer the following questions as honestly as you can. For each question, please tick the relevant box. Please leave any questions you are unwilling to answer blank, however please note that all answers are confidential and cannot be traced back to you.

How would you describe your gender?

Female	
Male	
Transgender	

How old are you?

21 or below	
21 – 29	
30 – 39	
40 – 49	
50 and above	

Do you work in your spare time to earn extra money?

Yes	No

Do you have children or are you a carer for another individual or family member?

Yes	No

Is English your first language?

Yes	No

Do you have any science-based qualifications? If so, what level are your qualifications, please tick all the relevant boxes below.

Please tick.

Doctorate	
Master's Degree	
Degree	
A Level	
B/TEC	
GCSE	
Other – please state	

Science based qualifications include biology/human biology, anatomy, physiology, microbiology, pharmacology, biochemistry, chemistry, physics etc.

Many thanks for taking time to complete my questionnaire.

Anthony Wheeldon RN, MSc, PGDip, BSc

(Professional Doctorate in Education student)

Appendix 3

Information sheets and consent forms.

Information sheet – Questionnaire

UNIVERSITY OF HERTFORDSHIRE

ETHICS COMMITTEE FOR STUDIES INVOLVING THE USE OF HUMAN PARTICIPANTS ('ETHICS COMMITTEE')

FORM EC6: PARTICIPANT INFORMATION SHEET

Title of study

A mixed methods exploration of student nurses' experiences and perspectives of their learning of bioscience on a contemporary nursing degree programme.

Introduction

You are being invited to take part in a study. Before you decide whether to do so, it is important that you understand the research that is being done and what your involvement will include. Please take the time to read the following information carefully and discuss it with others if you wish. Do not hesitate to ask me anything that is not clear or for any further information you would like to help you make your decision. Please do take your time to decide whether or not you wish to take part. The University's regulations governing the conduct of studies involving human participants can be accessed via this link:

http://sitem.herts.ac.uk/secreg/upr/RE01.htm

Thank you for reading this.

What is the purpose of this study?

I am seeking to gauge student perspectives on the learning of Bioscience in comparison to other elements of the nursing curriculum. I would also like to learn more about the challenges students may face when learning Bio-scientific subjects. Bioscience is an umbrella term for the following topics.

Anatomy

Physiology

Pathophysiology

Microbiology

Pharmacology

Do I have to take part?

It is completely up to you whether or not you decide to take part in this study. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. Agreeing to join the study does not mean that you have to complete it. You are free to withdraw at any stage without giving a reason. A decision to withdraw at any time, or a decision not to take part at all, will not affect any treatment/care that you may receive (should this be relevant).

Are there any age or other restrictions that may prevent me from participating?

No

How long will my part in the study take?

If you decide to take part in this study, it will take you between 5 – 10 minutes to complete.

What will happen to me if I take part?

You will be asked to complete a short questionnaire.

What are the possible benefits of taking part?

I hope that the data collected in this study will inform a much larger project that will explore how students manage their learning of Bioscience subjects. The results of the larger study will be used to enhance nursing curricula for future students.

How will my taking part in this study be kept confidential?

Your responses are completely confidential and cannot be traced back to you. You are not obliged to answer all questions and can choose not to answer questions if you wish.

What will happen to the data collected within this study?

The date collected in the study will be used as part of a thesis which will lead to a Professional Doctorate in Education (EdD). The questions will be kept for reference for the duration of my course, which is expected to continue for a further 4 years.

Who has reviewed this study?

The University of Hertfordshire Social Sciences, Arts and Humanities Ethics Committee with Delegated Authority

The UH protocol number is.

Who can I contact if I have any questions?

If you would like further information or would like to discuss any details personally, please get in touch with me, in writing, by phone or by email:

Anthony Wheeldon, Room LF277, The Wright Building, College Lane, Hatfield

Tel: 01707 284461

Email: a.r.wheeldon@herts.ac.uk

Although we hope it is not the case, if you have any complaints or concerns about any aspect of the way you have been approached or treated during the course of this study, please write to the University's Secretary and Registrar.

Thank you very much for reading this information and giving consideration to taking part in this study.

Information sheet – Focus Group

UNIVERSITY OF HERTFORDSHIRE

ETHICS COMMITTEE FOR STUDIES INVOLVING THE USE OF HUMAN PARTICIPANTS ('ETHICS COMMITTEE')

FORM EC6: PARTICIPANT INFORMATION SHEET

Title of study

A mixed methods exploration of student nurses' experiences and perspectives of their learning of bioscience on a contemporary nursing degree programme.

Introduction

You are being invited to take part in a study. Before you decide whether to do so, it is important that you understand the research that is being done and what your involvement will include. Please take the time to read the following information carefully and discuss it with others if you wish. Do not hesitate to ask me anything that is not clear or for any further information you would like to help you make your decision. Please do take your time to decide whether or not you wish to take part. The University's regulations governing the conduct of studies involving human participants can be accessed via this link:

http://sitem.herts.ac.uk/secreg/upr/RE01.htm

Thank you for reading this.

What is the purpose of this study?

I am seeking to gauge student perspectives on the learning of Bioscience in comparison to other elements of the nursing curriculum. I would also like to learn more about the

challenges students may face when learning Bio-scientific subjects. Bioscience is an umbrella term for the following topics.

Anatomy

Physiology

Pathophysiology

Microbiology

Pharmacology

Do I have to take part?

It is completely up to you whether or not you decide to take part in this study. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. Agreeing to join the study does not mean that you have to complete it. You are free to withdraw at any stage without giving a reason. A decision to withdraw at any time, or a decision not to take part at all, will not affect any treatment/care that you may receive (should this be relevant).

Are there any age or other restrictions that may prevent me from participating?

No

How long will my part in the study take?

If you decide to take part in this study, it will take you between 45 - 60 minutes to complete.

What will happen to me if I take part?

You will be asked to participate in a focus group and discuss your experiences of learning bioscience with other nursing students. The focus groups will be recorded and analysed for recurrent themes and common experiences. Each focus group will last between 45 and 60 minutes.

What are the possible benefits of taking part?

I hoped that the data collected in this study will provide insight into the student experience of learning bioscience in a modern BSc curriculum. Tutors will use this data to enhance bioscience learning and teaching for future cohorts.

How will my taking part in this study be kept confidential?

All information divulged in focus groups are completely confidential and cannot be traced back to you.

What will happen to the data collected within this study?

The data collected in the study will be used as part of a thesis which will lead to a Professional Doctorate in Education (EdD). The recordings will be kept for reference for the duration of my course, which is expected to continue for a further 4 years.

Who has reviewed this study?

The University of Hertfordshire Social Sciences, Arts and Humanities Ethics Committee with Delegated Authority

The UH protocol number is acEDU/PGR/UH/02830(1)

Who can I contact if I have any questions?

If you would like further information or would like to discuss any details personally, please get in touch with me, in writing, by phone or by email:

Anthony Wheeldon, Room LF277, The Wright Building, College Lane, Hatfield

Tel: 01707 284461

Email: a.r.wheeldon@herts.ac.uk

Although we hope it is not the case, if you have any complaints or concerns about any aspect of the way you have been approached or treated during the course of this study, please write to the University's Secretary and Registrar.

Thank you very much for reading this information and giving consideration to taking part in this study.

Consent form – questionnaire and focus groups

UNIVERSITY OF HERTFORDSHIRE

ETHICS COMMITTEE FOR STUDIES INVOLVING THE USE OF HUMAN PARTICIPANTS

('ETHICS COMMITTEE')

FORM EC3

CONSENT FORM FOR STUDIES INVOLVING HUMAN PARTICIPANTS

I, the undersigned *[please give your name here*, *in BLOCK CAPITALS]*

……..…

of [*please give contact details here, sufficient to enable the investigator to get in touch with you, such as a postal or email address]*

…..……

hereby freely agree to take part in the study entitled "A mixed methods exploration of student nurses' experiences and perspectives of their learning of bioscience on a contemporary nursing degree programme."

……..

(UH Protocol number acEDU/PGR/UH/02830(1))

1 I confirm that I have been given a Participant Information Sheet (a copy of which is attached to this form) giving particulars of the study, including its aim(s), methods and design, the names and contact details of key people and, as appropriate, the risks and potential benefits, how the information collected will be stored and for how long, and any plans for follow-up studies that might involve further approaches to participants. I have also been informed of how my personal information on this form will be stored and for how long. I have been given details of my involvement in the study. I have been told that in the event of any significant change to the aim(s) or design of the study I will be informed and asked to renew my consent to participate in it.

2 I have been assured that I may withdraw from the study at any time without disadvantage or having to give a reason.

3 In giving my consent to participate in this study, I understand that voice, video, or photo-recording will take place and I have been informed of how/whether this recording will be transmitted/displayed.

4 I have been given information about the risks of my suffering harm or adverse effects. I have been told about the aftercare and support that will be offered to me in the event of this happening, and I have been assured that all such aftercare or support would be provided at no cost to myself.

5 I have been told how information relating to me (data obtained in the course of the study, and data provided by me about myself) will be handled: how it will be kept secure, who will have access to it, and how it will or may be used.

6 I understand that my participation in this study may reveal findings that could indicate that I might require medical advice. In that event, I will be informed and advised to consult my GP. If, during the study, evidence comes to light that I may have a pre-existing medical condition that may put others at risk, I understand that the University will refer me to the appropriate authorities and that I will not be allowed to take any further part in the study.

7 I understand that if there is any revelation of unlawful activity or any indication of non-medical circumstances that would or has put others at risk, the University may refer the matter to the appropriate authorities.

8 I have been told that I may at some time in the future be contacted again in connection with this or another study.

Signature of participant……..…Date…….

Signature of (principal) investigator Date 19/10/18

Name of (principal) investigator *[in BLOCK CAPITALS please]*

ANTHONY WHEELDON

Appendix 4

Stimulus for focus group discussion.

BSc (Hons) Nursing (Adult)

Assignment

Research and answer the following questions:

1) Write an in-depth exploration of the pathophysiology of hyperthyroidism and its effect on metabolism. Include a detailed analysis of the physiological assessments a staff nurse should undertake to determine the impact of this disorder on a patient's cardiovascular and nutritional status.
2) Provide a comprehensive analysis of renal physiology and explain the impact of diuretic therapy on an individual's fluid balance. Your answer should include a detailed list of physiological assessments the nurse should undertake to determine fluid balance. Each identified assessment must be accompanied by an in-depth physiological rationale.
3) Write a critical exploration of the importance of regular blood pressure, pulse, and respiratory rate recordings for someone with life-threatening asthma. Your answer must include reference to oxygen delivery (DO_2), oxygen consumption (VO_2), acid-base balance, peripheral resistance, and external respiration.

Appendix 5

Summary of the initial thirty-four themes identified in the qualitative phase of the study.

1	Barriers	Students feel there are barriers that inhibit or hinder their learning of bioscience. These perceived barriers are encountered in both practice and classrooms.
2	Bias	The notion that in nursing curricula there is a bias towards non-bioscience subjects such as, social sciences, communication, research/evidence-based healthcare.
4	Bionursing	The idea that students need to understand human biology, pathophysiology, microbiology, and pharmacology to a level that will enable them to safely care for someone. This perceived bespoke subject area has been referred to as 'bionursing.'
5	Burden of responsibility	Students feel a burden of responsibility. This relates to a 'their life in your hands' concept, in which students worry that they do not know enough to carry out their job properly, and that potentially negative consequences could occur.
6	Care	Care is fundamental to nursing. However, from a student perspective effective care only occurs if nurses understand bioscience.
7	Change	Nursing is changing. Students recognise these changes

		but feel that they intensify the need to be bioscience savvy.
8	Communication	The notion that communication in healthcare settings is challenging and nerve wracking. Students feel this could be alleviated if they had a better understanding of bioscience.
9	Curriculum	The idea that the curriculum is to blame for the students' lack of bioscience knowledge.
10	Difference	The notion that there are diverse types of students and nurses. Some students feel that these differences influence how students set about learning bioscience and/or teaching bioscience.
11	Disparity	Students feel there is too much disparity between the reality of nursing practice and the university experience.
12	Fear/Anxiety	Students are anxious or have a range of fears about practicing or being in practice. The subtext is that these fears and anxieties could be alleviated or reduced if they had greater understanding of bioscience.
13	Frequency	Students feel that their understanding of bioscience would be enhanced with more frequent teaching/assessment.
14	Futility	Students often express feelings of futility, suggesting that learning bioscience is so challenging, it is futile trying to do so.
15	Identity	Students assume different identities. Each expressed in

		relation to the use of bioscience in nursing.
16	Interest and enthusiasm	Many students claim that they find bioscience interesting, exciting, and rewarding. It is also claimed that their interest and excitement is enhanced through their passion for an area of nursing practice.
17	Knowing and Knowledge	Students express many opinions that relate to knowledge or knowing in terms of learning bioscience and being an effective practitioner.
18	Lack of exposure	The idea that the learning of bioscience is problematic due to a lack of exposure to phenomena that the students feel will enhance their learning.
19	Lack of value	Students do not value aspects of their learning. A lack of value in non-bioscience topics and evidence-based care. They also notice a lack of value in these areas in the professionals they encounter.
20	Learning	Students express many opinions that relate to learning and how they learn and their understanding of the nature of their learning and their preparation for professional practice.
21	Low self-esteem	The way students express themselves often suggests they have low self-esteem, especially when comparing themselves to others, in terms of bioscience knowledge.
22	Motivation	Students express many opinions that relate to their motivations in relation to preparation for practice.
23	Objectivity	Some students feel there is a distinct difference between

		bioscience and non-bioscience. Bioscience is objective and fact based, whereas non-bioscience is subjective and open to interpretation. The underlying principle being that objective is good, whereas subjective is not always.
24	Overwhelming	A common theme in discussion is that the learning of bioscience is overwhelming.
25	Pedagogy	Students express many opinions that relate to pedagogy in relation to the nature of their learning and their preparation for professional practice.
26	Practice	Students express many opinions that relate to practice and its impact on their learning of the biosciences.
27	Procrastination	Procrastination is a common theme; the subtext is that bioscience is so challenging students avoid it.
28	Professional language and culture	Students feel that professional language and the culture of nursing hampers/hinders the learning of bioscience. This may help explain why students feel the learning of bioscience is challenging.
29	Reality	Reality as opposed to the perceived fiction of the classroom. Students feel that the classroom is totally divorced from placement and that this hampers their learning.
30	Self as a learner	Students sometimes express views that demonstrate how they see themselves as learners of bioscience.
31	Stress	Students often refer to stress or to being stressed.

		Often in relation to learning the biosciences in placement and in the classroom.
32	Tutors	Students feel that tutors and their relationships with them hampers/hinders the learning of bioscience.
33	Vital/Important	Students often express that things are important or vital.
34	Victim	Students often see themselves as victims of poor service or of circumstance.