

https://dspace.org/

The learning styles and study behaviours of Anaesthetists in a postgraduate training programme

Mahomed, Sameerah

2017

https://hdl.handle.net/10539/30165

Mahomed, S. The learning styles and study behaviours of anaesthetists in a postgraduate training programme. Johannesburg: University of Witwatersrand. 2017

Downloaded from a DSpace repository. https://dspace.org/

The Learning Styles and Study Behaviours of Anaesthetists in a Postgraduate Training Programme

Sameerah Mahomed

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Anaesthesiology.

Johannesburg, 2017.

DECLARATION

I, Sameerah Mahomed, declare that this Research Report is my own, unaided work. It has been submitted for the Degree of Master of Medicine in the branch of Anaesthesiology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

_____

7th day of August 2017 in Johannesburg

DEDICATION

To my grandad, who first instilled in me the love for reading and writing,

I hope you are smiling wherever you are.

To mum,

I am because you are.

To those who are facing what seems like an insurmountable hurdle,

"Courage does not always roar. Sometimes, courage is the quiet voice at the end of the day saying, 'I will try again tomorrow'."

ABSTRACT

The Part I examination in anaesthesiology in South Africa has historically attracted a low average national pass rate of 50% or less. The medical and educational literature has shown that students' approaches to learning, amongst other factors, may impact their educational and assessment outcomes. Therefore, the aim of this study was to describe the learning styles and study behaviours of anaesthetists in the postgraduate programme at Wits, particularly in the context of their preparation for the Part I examination.

A prospective, cross-sectional, contextual, descriptive study was conducted amongst all anaesthetists who were on the Wits circuit, who had attempted the Part I examination from 2010 to 2015. A self-administered questionnaire was used for data collection. Measures were put in place to maintain confidentiality of the participants, as well as to ensure validity and reliability of the study.

This study showed that anaesthetists at Wits were diverse in their approaches to learning, with average scores of 70% for deep learning, 67.8% for strategic learning and 60.8% for surface learning styles. Females were significantly more strategic than males ($p=0.03$) and those who had passed on first attempt at the Part I examination scored significantly higher on the "organised studying" sub-scale ($p=0.048$). This study further suggests that the anaesthetists may not necessarily be attuned to the requirements of adult learning when compared to their international counterparts in other disciplines. This may be a result of various academic and non-academic challenges cited by the anaesthetists in their experience with the Part I examination. In attempting to overcome these challenges, the anaesthetists had to adapt their study behaviours and develop effective coping mechanisms in order to be successful in the examination. This study further emphasises the need for constructive alignment within the adult educational system.

ACKNOWLEDGEMENTS

To my research supervisors Juan, Helen & Lionel…the completion of this project would have been near impossible without your patience, guidance and support. Thank you immensely.

To Professor Lundgren, thank you for your part in the timeous submission of my protocol.

To Dr Paul Abrahams and to the College of Anaesthetists (CMSA), thank you for your assistance.

To my colleagues who took the time to painstakingly fill out my questionnaire; this study would have been impossible without you.

TABLE OF CONTENTS

DECLARATION II
DEDICATION III
ABSTRACT IV
ACKNOWLEDGEMENTS V
TABLE OF CONTENTS VI
LIST OF FIGURES X
LIST OF TABLES XI
ABBREVIATIONS XII

CHAPTER 1 | OVERVIEW OF THE STUDY 1

1.1. INTRODUCTION 1
1.2. BACKGROUND 1
1.3. PROBLEM STATEMENT 3
1.4. AIM OF THE STUDY 5
1.5. OBJECTIVES OF THE STUDY 5
1.6. RESEARCH ASSUMPTIONS 6
1.7. DEMARCATION OF THE STUDY FIELD 8
1.8. RESEARCH METHODOLOGY 8
1.9. SIGNIFICANCE OF THE STUDY 9
1.10. OVERVIEW OF THE RESEARCH REPORT 11
1.11. SUMMARY 11

CHAPTER 2 | LITERATURE REVIEW 12

2.1. INTRODUCTION 12
2.2. BACKGROUND 12
2.3. THE LEGAL FRAMEWORK GOVERNING HEALTH CARE PROFESSIONS IN SOUTH AFRICA 13
2.4. COMPETENCIES OF AN ANAESTHESIOLOGIST 14
2.5. QUALIFYING AS AN ANAESTHESIOLOGIST IN SOUTH AFRICA 15
2.5.1. The prescribed curriculum 16
2.5.2. The prescribed Part I syllabus 16
2.5.3.Assessment 17
2.5.4. Examination guidelines and feedback 18

2.6. BASIC SCIENCES IN ANAESTHESIOLOGY 19
2.7. CONSTRUCTIVE ALIGNMENT 22
2.8. EXPERTISE, LEARNING AND THE STUDAX 25
2.8.1. Expertise 25
2.8.2. A perspective on cognitive learning: Cognitive Load Theory 26
2.8.3. The Studax 29
2.9. LEARNING STYLES AND STUDY BEHAVIOURS 31
2.9.1. Learning styles 31
2.9.2. The Approaches and Study Skills Inventory for Students questionnaire 33
2.9.3. Study behaviours 39
2.10. COMPLEXITY: THE LIFE OF A REGISTRAR 41
2.11. SUMMARY 44

CHAPTER 3 | RESEARCH METHODOLOGY 45

3.1. INTRODUCTION 45
3.2. PROBLEM STATEMENT 45
3.3. AIM OF THE STUDY 46
3.4. OBJECTIVES OF THE STUDY 46
3.5. ETHICAL CONSIDERATIONS 47
3.6. RESEARCH METHODOLOGY 48
3.6.1. Study design 48
3.6.2. Study population 49
3.6.3. Study sample 49
3.6.4. Inclusion and exclusion criteria 50
3.7. DATA COLLECTION 50
3.7.1. Data collection instrument 50
3.7.2.Data collection method 51
3.7.3. Data analysis 52
3.8. VALIDITY AND RELIABILITY 52
3.9. SUMMARY 53

CHAPTER 4 | RESULTS & DISCUSSION 54

4.1. INTRODUCTION 54
4.2. SAMPLE REALISATION 55

4.3. RESULTS 56
4.3.1. Demographics 56
4.3.2. PRIMARY OBJECTIVES 60
Primary objective 1: to describe the perceptions of learning amongst the anaesthetists 60
Primary objective 2: to describe the learning styles amongst the anaesthetists based on the ASSIST questionnaire 61
Primary objective 3: to describe the use of study strategies amongst the anaesthetists using the ASSIST questionnaire 62
Primary objective 4: to describe the use of preparation strategies for the Part I examination as reported by the anaesthetists 63
Primary objective 5: to describe the challenges faced by the anaesthetists with regard to their preparation for, as well as with the Part I examination itself 67
4.3.3. SECONDARY OBJECTIVES 72
Secondary objective 1: to compare the learning styles of the anaesthetists according to the ASSIST based on their gender 72
Secondary objective 2: to compare the learning styles and study strategies of the anaesthetists according to the ASSIST based on their number of attempts at the Part I examination 73
Secondary objective 3: to describe the study behaviours of those anaesthetists who were successful on their first attempt at the Part I examination. 74
Secondary objective 4: to describe the suggestions made by the anaesthetists on how the Department of Anaesthesiology may improve its support of teaching and learning for the Part I examination. 76
4.4. DISCUSSION 78
4.5. SUMMARY 90

CHAPTER 5 | SUMMARY, LIMITATIONS, RECOMMENDATIONS & CONCLUSION OF THE STUDY 91

5.1. INTRODUCTION 91
5.2. SUMMARY OF THE AIM AND OBJECTIVES OF THE STUDY 91
5.3. SUMMARY OF THE RESEARCH METHODOLOGY 92
5.4. SUMMARY OF THE RESULTS 92
5.5. LIMITATIONS 93
5.6. RECOMMENDATIONS 94
5.6.1. Recommendations for practice 94

5.6.2. Recommendations for further research 96
5.7. CONCLUSION 97
REFERENCES 98
APPENDICES 109
Appendix A – Approval of title 109
Appendix B – Ethics Committee approval 110
Appendix C – Author's permission 111
Appendix D – Information letter 112
Appendix E - Questionnaire 113

LIST OF FIGURES

FIGURE 4.2. SCORING OF THE ANAESTHETISTS STUDY PLANS ACCORDING TO THE AMOUNT OF DETAIL PROVIDED 63

FIGURE 4.3. ANAESTHETISTS' USE OF PERSONAL STUDY RESOURCES 65

FIGURE 4.4. NUMBER OF ANAESTHETISTS WHO FOUND THE TEACHING TO BE USEFUL 66

FIGURE 4.5. NUMBER OF ANAESTHETISTS WHO FOUND THE TEACHING TO BE NOT USEFUL/INADEQUATE 66

FIGURE 4.6. USE OF PERSONAL STUDY RESOURCES 75

FIGURE 5.1. RECOMMENDATIONS FOR POTENTIAL PART I CANDIDATES 95

LIST OF TABLES

TABLE 2.1. STUDAXOLOGY: DETERMINANTS OF STUDY BEHAVIOUR 29

TABLE 2.2. LEARNING STYLES AND THEIR CONSTITUENT SUB-SCALES (REPRODUCED FROM THE ASSIST QUESTIONNAIRE) 34

TABLE 2.3. FACTORS AFFECTING RESIDENTS' PROFESSIONAL PERFORMANCE 43

TABLE 3.1. ASSIST LEARNING STYLES AND THEIR COMPOSITE SUB-SCALES USED IN THIS STUDY 51

TABLE 4.1. SAMPLE REALISATION 55

TABLE 4.2. PERSONAL DEMOGRAPHICS OF THE ANAESTHETISTS 56

TABLE 4.3. PROFESSIONAL DEMOGRAPHICS OF THE ANAESTHETISTS 57

TABLE 4.4. OUTCOMES OF THE PART I EXAMINATION (FCA AND MMED) 58

TABLE 4.5. LEARNING STYLES OF THE ANAESTHETISTS BASED ON THE ASSIST QUESTIONNAIRE 61

TABLE 4.6. ANAESTHETISTS' USE OF STUDY STRATEGIES BASED ON THE ASSIST QUESTIONNAIRE 62

TABLE 4.7. COMPONENTS OF THE ANAESTHETISTS' STUDY PLANS 64

TABLE 4.8. TIME MANAGEMENT DURING INTENSIVE STUDY PERIOD 65

TABLE 4.9. PREPARATION CHALLENGES FACED BY THE ANAESTHETISTS 67

TABLE 4.10. COPING STRATEGIES EMPLOYED BY THE ANAESTHETISTS 69

TABLE 4.11. EXAMINATION CHALLENGES FACED BY THE ANAESTHETISTS 70

TABLE 4.12. ANAESTHETISTS PERCEIVED RELEVANCE OF THE PART I EXAMINATION 71

TABLE 4.13. COMPARISON OF LEARNING STYLES BASED ON GENDER 72

TABLE 4.14. COMPARISON OF LEARNING STYLES BASED ON NUMBER OF ATTEMPTS TO SUCCESS 73

TABLE 4.15. TIME MANAGEMENT DURING INTENSIVE STUDY PERIOD 74

TABLE 4.16. SUGGESTIONS FOR THE IMPROVEMENT OF THE PART I TEACHING PROGRAMME 76

ABBREVIATIONS

ABSITE – American Board of Surgery In-training Examination

ASI – Approaches and Study Skills Inventory

ASSIST – Approaches and Study Skills Inventory for Students

CA – College of Anaesthetists

CBE – Competency-based education

CHBAH – Chris Hani Baragwanath Academic Hospital

CLT – Cognitive load theory

CMJAH – Charlotte Maxeke Johannesburg Academic Hospital

CMSA – Colleges of Medicine of South Africa

FCA – Fellow/fellowship of the College of Anaesthetists

FRCA – Fellow of the Royal College of Anaesthetists

GMC – General Medical Council

HJH – Helen Joseph Hospital

HPCSA – Health Professions Council of South Africa

ICU – Intensive Care Unit

LTM – Long-term memory

M&M – Morbidity and mortality meetings

MCQ – Multiple choice questions

MMed – Master of Medicine degree (in the branch of Anaesthesiology)

RCoA – Royal College of Anaesthetists

RMMCH – Rahima Moosa Mother and Child Hospital

WDGMC – Wits Donald Gordon Medical Centre

WITS – University of Witwatersrand

WM – Working memory

Chapter 1 | Overview of the Study

1.1. Introduction

This chapter provides a brief overview of the study.

1.2. Background

In the realm of postgraduate training and qualification in any medical specialty there is a pronounced emphasis on sound clinical knowledge (1-3). However, the emphasis on how to gain this knowledge appears to receive significantly less consideration.

As a student in a postgraduate medical programme, it is not uncommon to be faced with a comprehensive syllabus, with the guidelines to achieving the objectives set out there-in scarcely suggesting more than self-directed, problem-based learning as the means to realising those objectives. The postgraduate programme in anaesthesiology at the University of the Witwatersrand (Wits) is one such programme (1).

The concept of self-directed learning speaks to the idea that ultimately students are responsible for what and how they learn (4-7). In this way students are meant to create meaning for themselves through what they learn (5).

In a system such as this, the need becomes apparent for alignment between students and their learning environment, in such a way that all aspects aim to support higher learning (4, 5, 8). In an "aligned" system, the desired outcomes with regard to topic content as well as the required depth of understanding is specified (4). This concept is described in the education literature as "constructive alignment" (4, 5). The problem-based learning system is said to be "alignment itself" where "the objectives are to get students to solve problems they will meet in their professional careers; the teaching method is to present them with problems to solve; and the assessment is based on how well they solve them" (5).

The assumption in postgraduate medical education is that students' prior medical knowledge would allow them to be more efficient in problem-based and self-directed learning processes (9). Added to this, is the assumption that in a well-aligned system, the student becomes "trapped" and inevitably learns what is intended (4, 5).

The average pass rate of 50% in the Part I fellowship examination (FCA (SA)) conducted by the College of Anaesthetists of South Africa (CA (CMSA)) (10) over the recent years (10) will attest to the fact that there is something amiss in the "alignment" in the system in postgraduate education in anaesthesiology.

Review of the medical education literature has shown unequivocally that students in higher education differ in their approach to learning and studying (3, 5, 11-19). This would in turn suggest that they relate and respond differently to their learning environments. What differentiates students in the way they learn and study, is the theoretical frame of reference which students use to develop and maintain the expertise to sustain themselves within their own context of studying (3).

Pillars supporting this framework are the individual learning styles and processes students use in their bid to acquire, retain and apply knowledge (5, 11-14, 18, 20-23). As an extension of learning styles, there are differences in the study skills, will and self-regulation in the way students learn. These factors are thought to jointly contribute to the final outcomes of a student's study endeavours. On a more tangible scale, these factors may reflect as the outcomes of assessment and examinations (3, 5, 12, 14, 16, 22, 24-32).

There has been well-documented evidence to support the idea that the nature of an examination or assessment has a direct influence on the way students approach their learning for that task (33, 34). The prescribed curriculum expects deep learning from students, so as to foster a more complete understanding as

well as to enable the recall of more factual details both in the short and long term (35). However, in an attempt to handle the immense cognitive load imposed by both the vast, non-weighted syllabus, as well as the current mode of assessment, students may be strongly encouraged to employ surface or strategic learning methods instead. (18, 36-38).

The question of why medical postgraduate students perform the way they do in primary and certification examinations is one that has been raised before by various disciplines when the performance was deemed to be less than satisfactory (2, 24, 25, 27, 31, 39-41). Dewey (42, 43) has defined a "problem" as "the discrepancy between what ought to be and what is". That on average, only half the candidates are successful at each sitting of the Part I examination in anaesthesiology, merits further investigation.

1.3. Problem statement

There are minimum requirements that need to be met on the road to qualifying as a specialist in anaesthesiology (44). Apart from the basic science and clinical knowledge-based assessments that need to be passed, there are also non-clinical competencies that the postgraduate student in anaesthesiology has to master (1, 45). One such competency involves the anaesthesiologist's role in self-education and the education of others in the form of an" exemplary scholar and teacher" (1).

The guidelines to achieving the objectives of the postgraduate training programme in anaesthesiology are set out within the published regulations and curriculum of the Colleges of Medicine of South Africa (CMSA) and CA (CMSA) respectively (1, 44). From the perspective of CA (CMSA) and the training institutions, these objectives should be realised through self-directed education and learning on the part of the student. Self-directed or problem-based learning has shown success in some instances of postgraduate training in anaesthesiology (9). If done correctly, with constructive alignment within the learning system,

students are said to become “entrapped” in a “web of consistency,” optimising the likelihood of students engaging in the appropriate learning activities needed to achieve the desired learning outcome (5).

On paper, the prescribed curriculum in anaesthesiology in South Africa satisfies the criteria of a problem-based curriculum. On paper, there appears to be some degree of constructive alignment within the system. However, the results of the primary examinations in anaesthesiology seem to suggest otherwise.

The national pass rates for the FCA (SA) Part I examinations from March 2010 to March 2014 have averaged at 50%, with the results in the March 2014 sitting reaching a near all-time low with a national pass rate of 42% (10). Results from the Master of Medicine (MMed) in the branch of Anaesthesiology primary examination are comparable, if not worse. This is alarming and a definite cause for concern - both for the trainees as well as the training institutions.

The individual reasons behind the failure of a student may be complex (46, 47). However, in view of the fact that on average, only half the number of the candidates that attempt the FCA (SA) Part I examinations in anaesthesiology are successful (and presumably even fewer being successful on the first attempt), one does not get the impression that those students are “entrapped in a web of consistency” where they inevitably learn what they are intended to.

This raises an important question: how are these candidates preparing for the examination? It has been shown in the literature that the way students learn impacts their outcomes in assessments (3, 5, 12, 14, 16, 22, 24-32). Granted, there may be several factors which influence their approach to learning (27, 39, 46). However, a closer assessment of the study styles and strategies candidates use in their preparation for the Part I examination may shed some light on the differences in the positive and negative outcomes of the examination.

1.4. Aim of the study

The aim of this study was to describe the learning styles and study behaviours of anaesthetists in the postgraduate programme at Wits, particularly in the context of their preparation for the Part I examination.

1.5. Objectives of the study

The aim of this study was achieved by means of the following objectives.

Primary objectives:

- to describe the perceptions of learning amongst the anaesthetists
- to describe the learning styles amongst the anaesthetists using the ASSIST questionnaire
- to describe the use of learning and study strategies amongst the anaesthetists using the ASSIST questionnaire
- to describe the study behaviours of the anaesthetists in preparation for the Part I examination
- to describe the challenges faced by the anaesthetists with regard to their preparation for, as well as with the Part I examination itself.

Secondary objectives:

- to compare the learning styles of the anaesthetists according to the ASSIST based on their gender
- to compare the learning styles of the anaesthetists according to the ASSIST based on their number of attempts at the Part I examination
- to describe the study behaviours of those anaesthetists who were successful on their first attempt at the Part I examination.
- to describe the suggestions made by the anaesthetists on how the Department of Anaesthesiology may improve its support of teaching and learning for the Part I examination.

1.6. Research assumptions

The following definitions were used in this study.

Anaesthetist: an anaesthesiologist, registrar or medical officer who works in the Department of Anaesthesiology.

Anaesthesiologist: a medical doctor who is accredited by the CA (CMSA) as a specialist in the field of anaesthesiology.

Junior consultant: an anaesthesiologist with less than 5 years' experience as a specialist anaesthetist.

Registrar: a medical doctor who is receiving advanced training in a specialist field i.e. anaesthesiology in order to qualify as an anaesthesiologist. Also referred to as "resident" in the American medical educational literature.

Junior registrar: a registrar who has not yet completed the senior rotations in anaesthesiology viz. neurovascular and cardiothoracic anaesthesia rotations.

Senior registrar: a registrar who is has passed the Part I examination and has completed both the senior rotations in anaesthesiology viz. neurovascular and cardiothoracic anaesthesia rotations.

Medical officer: a medical doctor who is post-community service and has already attained a Diploma in Anaesthesiology and has attempted the Part I examination.

Wits circuit: Five hospitals are affiliated to Wits: Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), Chris Hani Baragwanath Academic Hospital (CHBAH), Helen Joseph Hospital (HJH), Rahima Moosa Mother and Child Hospital (RMMCH) and the Wits Donald Gordon Medical Centre (WDGMC).

Part I examination: the primary specialisation examination based on basic science knowledge related to anaesthesiology. At the time of this study, this

examination was offered by CA (CMSA) (FCA (SA) Part I) as well as by some South African universities (MMed Part I). A candidate needs to have passed the Part I examination in order to be eligible to write the final certification examinations to qualify as an anaesthesiologist.

Learning style: also referred to learning approach, is used to describe the approach to learning i.e. deep, superficial or strategic. The terms "learning styles" and "approaches to learning" are used interchangeably in this study.

Deep approach: is used in an "attempt to understand material and integrate it with one's existing knowledge structure to construct a global picture characterised by intrinsic motivation" (14).

Surface approach: is "the reliance on rote learning and memorisation that allows reproduction of learned material**,** characterised by extrinsic task motivation" (14).

Strategic approach: is used when the "focus is on achieving good grades through any means necessary**,** characterised by a systematic study routine that may be surface or deep in nature". (14).

Study behaviours: is the combination of study skills and study habits which characterise strategic learning. This is also referred to as study strategies.

Study skills: are the "ability to manage time and allocate other resources in accordance with the demands of the academic tasks", and the "ability to organise, summarise, and integrate material" (14).

Study habits: are "study routines, including, but not restricted to, frequency of studying sessions, review of material, self- testing, rehearsal of learned material, and studying in a conducive environment**"** (14).

Approaches and Study Skills Inventory for Students (ASSIST): The ASSIST is a self-administered questionnaire which was developed with the intention to help

identify “students at risk through ineffective learning strategies” (48). It combines “knowledge about learning styles with descriptions of a strategic approach to studying” (49). It was designed to demonstrate students’ relative strengths and weaknesses in their approaches to learning in three main scales/constructs: deep, surface and strategic – all of which may contribute to different learning outcomes (48, 49).

1.7. Demarcation of the study field

This study was conducted within the Department of Anaesthesiology in the School of Clinical Medicine, Faculty of Health Sciences at Wits in Johannesburg, South Africa. At the time of the study, the department had 74 anaesthesiologists, 107 registrars and 27 medical officers. For any given three-month rotation, there were on average 27 registrars at CMJAH, 38 registrars at CHBAH, 15 at HJH/RMMCH and five or six registrars on each of the specialist rotations viz. intensive care (ICU), neurovascular and cardiothoracic anaesthesia blocks. A further two registrars rotate for two to four weeks at a time at Klerksdorp/Tshepong Hospital Complex.

1.8. Research methodology

A prospective, cross-sectional, contextual, descriptive study design was used in this study. The study population comprised all anaesthetists who were on the Wits circuit at the time of the study, who had attempted the Part I examination from 2010 to 2015.

The researcher developed a questionnaire based on the validated ASSIST questionnaire, in consultation with an expert in the fields of Anaesthesiology and Education. Ethics and other relevant approvals were obtained prior to conducting the study.

A purposive sampling method was used, and the questionnaires were administered to the entire accessible population. All anaesthetists who were invited to participate in the study were provided with a questionnaire which they

were allowed to take home and complete at their convenience until the end of the data collection period. In in order to preserve anonymity, no identifying data were collected. In order to maintain confidentiality, questionnaires were returned by the participants directly into a sealed, marked box which was opened once the data collection period had ended. Data were collected from December 2015 to July 2016. Descriptive and inferential statistics were used to report the results of the study. Measures were put in place to ensure the validity and reliability of the study.

1.9. Significance of the study

It is the reality for a postgraduate student in anaesthesiology in South Africa today that qualification as an anaesthesiologist is not possible without first passing the primary examination in anaesthesiology (44). The low pass rates in these examinations are a cause for concern (2, 10). The burden of responsibility may not fall on one part of the system alone: it is well-recognised that the success or failure of an endeavour of this nature is dependent on a multitude of factors (27, 46, 47). However, within this particular context of "learners" in their learning environment, there are specific factors that can be looked upon as contributors to the outcomes of a student undertaking the Part I examination in anaesthesiology (3, 5, 12, 14, 16, 22, 24-32).

The postgraduate terrain in anaesthesiology and the transition from undergraduate to postgraduate education may be fragmented and some may have difficulty in adapting (50, 51). Therefore, the contribution of each component of the learning system plays a pivotal role (4, 8, 52, 53) The theme of constructive alignment in an educational programme resurfaces time and again, highlighting the need for the institution in their mode of curriculum design and assessment, to provide a structure which will underpin, as opposed to hinder, the learning process of the student (4, 38, 40, 54).

This does not take away from the students' own responsibility towards their preparation and learning, but rather, augments it. The roles students play in their own education cannot be emphasised enough (3, 5), and generally, students who had previously achieved success have identified the best study method for themselves (53).

It is therefore the aim of this study to identify and describe the learning styles and study behaviours of this group of anaesthetists in their approach to the Part I examination. It would show lack of insight to confer that the outcome on any given examination or assessment is solely dependent on just one or two factors, such as the learning styles or the study behaviours of a student. However, understanding the preparation strategies that these anaesthetists have used may shed light on what may be constructive study behaviour, as well as uncover possible weaknesses and obstacles in their path of learning.

It is hoped that the awareness raised by this study will be welcomed not only by students aspiring to be successful in the Part I examinations in anaesthesiology, but also by those who are involved with the curriculum and assessment design.

The psychology of failure is peculiar. In some, it may become a motivator to do better next time. But for others, failure initiates a grim cycle of demotivation and repeated failure (3). The ripple effect of failure may be far-reaching: from student to institution to the community at large, where there is an ever-increasing demand for more specialists. Failure is just a symptom of a deeper problem (42, 43). Unless an active effort is made to get to the root of the problem, the constant drain from a failing enterprise will be one that is difficult to recover from. The intention behind this study is to open the door to that conversation.

1.10. Overview of the research report

The research report will be presented in the following chapters:

Chapter 1: Overview of the study

Chapter 2: Literature review

Chapter 3: Research methodology

Chapter 4: Results & discussion

Chapter 5: Conclusion

1.11. Summary

This chapter gave an overview of the study background, the problem statement, aim and objectives, demarcation of the study field, ethical considerations, research methodology, significance of the study, and a research report outline. The literature review is presented in the following chapter.

Chapter 2 | Literature Review

2.1. Introduction

This chapter comprises a review of the medical and educational literature, providing a background for the study.

2.2. Background

Anaesthesiology is a branch of medicine and those who practice anaesthesiology are called "anaesthetists" (55). Anaesthetists are medically qualified doctors whose primary role has always been to provide anaesthesia care to patients undergoing surgical procedures (55, 56). Resuscitation, providing care in intensive care and obstetric units, acute and chronic pain management, as well as teaching and education are some of the roles of present-day anaesthetists outside of the operating theatre (55, 56).

Anaesthetists who complete the four to five year postgraduate training programme in anaesthesiology (also known as specialisation) are then known as "anaesthesiologists" (55).

Anaesthesiologists are considered experts in their field (1, 45). Therefore, over and above being a medical expert, an anaesthesiologist is expected to be competent in the roles of communicator, collaborator, manager, health advocate, a scholar and teacher, and a professional (1, 45). Becoming an expert requires two things: The first is a mastery of problem-solving skills within a "well-defined occupational or disciplinary domain" (3). The second is mastery and development of expertise in one's methods of studying (3). The fulfilment of the first necessitates the second (3).

Janssen (3), in his elucidation of the expertise needed by students to be successful in higher education, identified that students may differ in the ways they experience their everyday study behaviour: some students are better able to

regulate themselves within a theoretical framework where "aspects of their study behaviour constitute a well-integrated behavioural 'whole' which they are able to maintain day after day" (3). Janssen uses the term "studax" to describe these students (3). Other students lack this expertise and find organising their study behaviour challenging, and remain ineffective in attaining their educational and academic goals (3).

In the educational literature, the study behaviours employed by students are attributed in parts to their preferred learning styles, the context in which their learning takes place (5, 11-15, 18, 22, 30, 35, 46, 52, 57, 58) as well as to their perception of the relevance of the subject matter to be studied (38, 59). These learning styles or "approaches" to learning can be described as deep, surface or strategic (12, 18, 35, 49, 52, 58, 60-62) and inventories such as Tait & Entwistle's Approaches to Study Styles Inventory (ASSIST) (60) and Biggs' Study Processes Questionnaire (SPQ) have been developed to describe these approaches (12, 14, 60, 63, 64). Studies (35, 62) have been conducted from as early as 1976 to investigate the relationship between students' learning approaches and strategies and their outcomes in summative assessments (16, 22, 24, 46, 49, 65-72), as well as their preferences for courses and modes of teaching (57, 73).

2.3. The legal framework governing health care professions in South Africa

All individuals who practise within the health professions which are regulated by the Health Professions Council of South Africa (HPCSA) are obliged by the Health Professions Act No. 56 of 1974 (74) to register with the HPCSA (75). The HPCSA is a statutory body established in accordance with the Health Professions Act as a measure to protect the public and to regulate the health professions with respect to registration, education and training, and professional and ethical conduct (75). This is to ensure continuing professional development, as well as foster compliance with healthcare standards (75).

One route to specialisation in South Africa is via a fellowship which is required for registration as a specialist by the HPCSA (76). The Fellowship in Anaesthesiology in South Africa (FCA (SA)) is conferred by CA (CMSA) which is a constituent of the CMSA (76). The CMSA is an organisation whose mission is to sustain and improve postgraduate medical education and training in Southern Africa (77). It is an internationally-recognised, independent examining body which provides guidance on issues pertaining medical standards as well as the structure and function of health care services, while promoting and maintaining ethical and professional standards (77).

2.4. Competencies of an anaesthesiologist

The objective of any postgraduate medical training programme is to produce competent specialist physicians who have acquired the necessary knowledge and skills to provide safe and quality care to their patients (37, 45, 78). Competency-based education (CBE), which stems conceptually from the notion that an expert physician is defined by a broad set of identified competencies (78) has gained momentum across several countries over the last decade (78). It has taken the form of the "CanMEDS roles" (45) in Canada, the "Accreditation Council for Graduate Medical Education (ACGME) competencies" (79) in the United States, "Tomorrow's Doctors" (37), which was reworked in 2016 to "Working with doctors working for patients" (80) in the United Kingdom, and "The Scottish Doctor" (81) in Scotland. The South African postgraduate curriculum in anaesthesiology (1) similarly has adopted CBE, and is modelled on the CanMEDS physician competency framework (45).

CBE in relation to anaesthesiology defines the anaesthesiologist's required competencies over and above being a medical expert, as a communicator, collaborator, manager, health advocate, a scholar and teacher, and a professional (1, 45). An anaesthesiologist should be able to satisfy the roles of both scholar and teacher simultaneously and independently (1, 45). The postgraduate

curriculum prescribed by CA (CMSA) (1) advocates that the anaesthesiologist as a "scholar" should "value advances in scientific knowledge and be able to identify and appraise them critically for incorporation into contemporary clinical practice". As a teacher, the anaesthesiologist is integral in contributing to the education and training of undergraduate students, interns, medical officers, registrars and other health professionals (45).

2.5. Qualifying as an anaesthesiologist in South Africa

A registrar is admitted as a "fellow" (specialist) to CA (CMSA) after passing a single exit examination known as the FCA (SA) Part II (1, 44). For admission to the Part II examination, the candidate needs to have passed a primary (Part I) examination in anaesthesiology. This may be the FCA (SA) or the MMed (Anaes) Part I examination from a South African university. Candidates must also have spent 36 months in a numbered training post , including three months in ICU, completed a portfolio of learning to be approved by the head of department (for registrars that started on or after 1 January 2010)(44).

The Part I examination may be undertaken by any candidate who has a qualification to practice medicine that is registered or can be registered as a Medical Practitioner with the HPCSA (44). The Part II examination, which is the certifying examination, must be passed within six years of passing the Part I examination (44). In addition, in order to register as a specialist with HPCSA, a research report has to be submitted and assessed at university level (82).

For the purpose of this review, further appraisal of the outlined curriculum will focus on three aspects: the syllabus that is expected to be covered for the Part I examination, the curriculum that forms the platform on which training takes place, and lastly, the summative assessment measures in place, with comments on guidelines and feedback surrounding the assessment.

2.5.1. The prescribed curriculum

In the prescribed postgraduate curriculum in anaesthesiology, a "domain" approach is used to provide a framework for training (1). This framework encompasses both the clinical as well as the non-clinical domains of anaesthesiology. The first section in this framework focuses on clinical practice, while the second introduces the concept of the holistic development of the specialist anaesthesiologist. To this end, aspects such as education, self-directed learning, research, professionalism and ethics gain prominence and are expected to be applied and adapted to all domains during the course of postgraduate training in anaesthesiology (1).

2.5.2. The prescribed Part I syllabus

Broadly speaking, anaesthesiologists-in-training are required to understand the subjects in the basic sciences relevant to anaesthesiology, as set out in the College of Anaesthetists' "Primary Syllabus" and MMed "Syllabus for the Basic Sciences in Anaesthesia and Intensive Care" (1, 44).

On examination of the 46 pages outlining the syllabus as presented by the Curriculum Revision Committee of the College of Anaesthetists (1), as well as the five pages in the CMSA guidelines for admission to the FCA (SA) (44) which is meant to provide "the overall scope of the examination in the three papers for the Part I examination", there is the impression that it is a vast, all-encompassing syllabus with little to no indication as to the depth of knowledge required per topic.

The list of topics included in the above guidelines (1, 44) fall under three subject headings, namely:

- Physics and Clinical Measurement including basic statistics.

- Pharmacology, both general principles and applied pharmacology as applicable to the various organ systems i.e. the cardiovascular, respiratory, nervous, haematological, endocrine, urinary and gastro-intestinal systems.
- Physiology and Chemical Pathology based on the organ systems listed above, as well as other aspects of physiology e.g. water and electrolytes, cell physiology, blood, basic immunology, intermediary metabolism, acid-base physiology, nutrition, the reproductive system and pregnancy including transitional physiology, and the extremes of age.

2.5.3. Assessment

The Part I candidate may choose to write either the FCA (SA) or the MMed (Anaes) Part I examination as both are recognised as satisfying the eligibility criteria for sitting the FCA (SA) Part II examination.

The formal Part I examination guidelines issued by CA (CMSA) applicable to the period from 2010-2014 was outlined as follows (10):

- "There will be two papers in each of the three Part I subjects.
- Paper 1 in each subject consists of four essay-type questions designed to test the candidate's depth of knowledge and understanding of the subjects chosen.
- Paper 2 in each subject replaces the viva voce examination and consists of 20 questions designed to examine breadth of knowledge in each of the three primary subjects."

Regulations regarding the criteria to pass the Part I examination were published In November 2013 on the CMSA website (44). These stated that:

> "In order to pass each subject, a candidate must achieve an average mark ≥ 50% for both papers combined and pass at least half the questions in each paper i.e. 2 long questions in one, and 10 short questions in the other.

A candidate who passes all three subjects in terms of the above rule will have passed the primary examination. A candidate who passes two of the three subjects, and has an average mark ≥ 40% for the failed subject, may attempt the failed subject at the next consecutive examination of the CMSA. A candidate who fails the remaining subject will be deemed to have failed the FCA (SA) Part I examination. Such a candidate will need to repeat all three subjects at a later (sitting of the) Part I examination (44)."

2.5.4. Examination guidelines and feedback

Unlike CA (CMSA) (1), other Colleges viz. Obstetricians and Gynaecologists, Surgeons and Physicians publish "blueprints" or guidelines which detail the maximum marks, percentage weighting and the number of questions to be expected per syllabus component in each examination (83-85). They also provide guidelines on whether components will be tested in a long-answer question or single best answer format. These are freely accessible on the relevant Colleges' webpages at any given time (83-85). This trend of published blueprints and detailed examination guidelines is in keeping with international standards where such information is published online, as with the Royal College of Anaesthetists (RCoA) (86).

The RCoA also publishes annual reports on the outcomes of both the primary and final examinations (87). At the end of each academic year, reports which review and summarise the outcomes of all RCoA Primary and Final FRCA examinations conducted during the academic year, are submitted to the Examinations Committee (87) . These annual reports are intended to be of value to examiners, Royal College departments, the General Medical Council (GMC), trainers, registrars and the public in general (87). These reports are published on the RCoA webpage, ensuring its availability to all who are interested (86, 87). This type of feedback from CA (CMSA) is lacking.

2.6. Basic sciences in anaesthesiology

It is clear that qualifying as an anaesthesiologist appears to depend heavily upon sound knowledge of the basic sciences (88). This is supported by the fact that the primary syllabus in anaesthesiology is based purely on the basic sciences and their application to clinical practice (1). The Part II candidate may also be questioned on basic sciences to any depth in the final written, clinical and oral examinations (1). This raises the question: "What is the role of the basic sciences in the practice of anaesthesiology?"

Professor of Anaesthesia, Wesley Bourne of McGill University in Montreal, Canada shed some light on the role of basic sciences in anaesthesia in the late 1940's:

> "That physiology is the requisite introduction to medicine, is a maxim which has long been held without dispute…As in medicine generally, so in its branches, the so-called basic sciences ought to be understood, and it is not surprising to find those men who have to do with the teaching of anaesthesia emphasising the importance of some special knowledge of anatomy, of biochemistry, of pharmacology and of physiology…Imbued with so much knowledge of those parts of physiology and its allied subjects which particularly illuminate his specialty, the student of anaesthesia will find himself equipped intellectually to attack those clinical problems, which are so varied and so ever-present in this branch of medicine." (89)

There is little dispute as to whether learning the basic sciences and their clinical application have a place in anaesthesia: the basic sciences form the foundation for clinical practice (89). However, it is arguable that perhaps not all topics in the prescribed syllabus are equally weighted in terms of being essential to the understanding and practice of everyday anaesthesia (38).

In 1997, Burnstein et al (38) conducted a survey amongst practising anaesthetists who were Fellows of the Royal College of Anaesthetists (FRCA) who were working

at a teaching hospital, as well as to all post-fellowship registrars in the Anglia region. The questionnaire dealt first with which basic sciences (and their constituents) are considered as essential or irrelevant to the understanding and practice of anaesthesia. This part of the survey was unprompted, and respondents were asked to give five topics under each heading. The second more structured part of the survey then assessed how well information which is felt to be essential, is retained by fellows who are likely to be invited to teach registrars. The questions there-in were based largely on the Primary FRCA syllabus (90), and partly on several anaesthetic texts commonly used for examination revision by registrars in the department. Next to each topic, the respondent had to indicate along a visual analogue scale to what extent they thought the topic was irrelevant or essential. They also had to indicate if they themselves would be able to give an impromptu tutorial on the topic to a prospective Primary FRCA candidate.

The survey reached a total of 78 fellows, of which 56 responded. There were 24 consultant/staff-grade responses, and the rest were post-fellowship registrars. The survey revealed that the anaesthetists considered 65% of the basic science syllabus as essential to the understanding and practice of everyday anaesthesia, with some difference in opinion with regards to specific topics (38). The study showed a high degree of agreement amongst all the anaesthetists regardless of level of experience, with no large differences in opinion on the relevance of most topics. However, a possible limitation of the study was that the anaesthetists' definitions of "everyday anaesthesia" may have varied according to their daily practice and areas of personal interest (38).

The aim of the second part of the survey questioned the anaesthetists as to whether they could give an impromptu tutorial on a particular primary topic so as to assess the retention of knowledge required for the examination (38). In this study, it is reported that there were many instances where participants said that particular topics were essential, but a high proportion of the same participants

could not actually give a tutorial on the same topics which they considered essential (38). Overall, the study found that in many cases a large number of anaesthetists were unable to give impromptu tutorials on the topics in the primary syllabus. Albeit a crude marker, it goes to say that if a topic is indeed essential to the practice of anaesthesia, it should be possible to impart that knowledge to others (38).

It is known that "the perceived relevance of the subject matter is an essential condition for adult learning" (59). Furthermore, amongst his "4 Principles of Androgogy", Knowles identified that "adults learn best when topics have immediate impact and relevance to their work" (91, 92). This study therefore raises two important questions. The first being whether primary candidates are overloaded with detail that has limited relevance to the clinical practice of anaesthesiology (38). The second is whether the curriculum warrants review in order to define a core syllabus which is condensed but more relevant to clinical anaesthesiology (38). In the paper entitled "Tomorrow's Doctors" (37, 93) the GMC highlighted the problems associated with an overloaded undergraduate curriculum which "imposes a scarcely tolerable burden of information" (cognitive load) on the students which "taxes the memory but not the intellect". Further, there is now advocacy for a curriculum which is no longer all-encompassing, but contains a core which is more rigorously defined (37, 93). This problem is said to prevalent at all levels of medical training (38).

A more recent study was conducted by De Oliveira Filho et al (59), which compared the perceived relevance of basic sciences to clinical practice of registrars (n=107) and anaesthesiologists (n=142). Although both groups agreed that the basic sciences were relevant to clinical practice and that was a need for in-depth formal learning of basic sciences prior to clinical application, the anaesthesiologists ratings were significantly higher on both accounts (59). This

may suggest that the relevance of a particular topic may become more apparent as one's experience increases.

Therefore, the implication of the studies conducted by both Burnstein (38) and De Oliveira Filho (59) is that the clinicians who teach the next generation of anaesthesiologists should have some input into the contents of the syllabus, and there should be formal feedback and communication between the fellows who are involved in teaching the syllabus, and those within the College who ultimately set the standards of practice (38).

2.7. Constructive alignment

Constructive alignment (also known as curriculum alignment) within an educational system, serves to bring into context the relationship between the student's learning, the learning environment as shaped by the institution setting the syllabus and the subsequent mode(s) of assessment of the knowledge gained by the student (4, 5, 8).

Professor John Biggs, an honorary Professor of Psychology, previously Professor of Education, at Hong Kong University, is the chief proponent of the concept of constructive alignment. In expansion of his theory, Biggs proposed that "teaching and learning take place in a whole system which embraces classroom, department and institutional levels. In a poor system, in which the components are not necessarily integrated and tuned to support learning, only 'academic' students spontaneously use higher-order learning processes. In an integrated system, on the other hand, all aspects of teaching and assessment are tuned to support high level learning" (4).

Within the concept of constructive alignment, the "constructive" aspect refers to the notion that students "construct meaning for themselves through relevant learning activity" (5). There is less emphasis on what is transmitted from teacher to student, whereby teaching becomes a catalyst for learning, as opposed to the

focus (3-5). The “alignment” aspect refers to “what the teacher does to create a learning environment that supports the appropriate learning activity to achieve the desired academic outcomes” (4, 5). In an aligned system, “the desired outcomes are specified, not only in terms of topic content, but in the level of understanding that should be achieved, and the mode of assessment is appropriate in measuring the students’ actual learning outcomes” (4, 93).

The curriculum as outlined by CA (CMSA), ties the clinical domains to the non-clinical, and highlights the educational goals to follow: registrars should acquire knowledge and skills in self-directed and educational goals, education and training of others, as well as in the planning and execution of a formal scientific enquiry (1).

Freedman (94) has described the adult learner as “someone who is motivated enough to want to pin further education at the end of a working day or is required to come to a program for certification”. Furthermore, as Mezirow (95) pointed out, "no concept is more central to what adult education is all about than self-directed learning". In this adult postgraduate programme, the emphasis is on self-directed learning, where the registrar navigates the syllabus and shoulders the responsibility of learning. In this regard, the curriculum (1) outlines the educational skills and knowledge that a registrar is expected to build up in the process of learning. Self-directed learning has historically been described as “a process in which individuals take the initiative without the help of others in diagnosing their learning needs, formulating goals, identifying human and material resources, and evaluating learning outcomes" (96). Therefore, the registrars are expected to learn educational skills early in the curriculum (Domains 1 and 2) (1). This in turn should enable them to generate a learning plan in which basic science knowledge is linked to clinical practice.

The recommendation by the curriculum designers is the use of a problem-based approach to learning as well as a learning portfolio to identify clinical problems in

their daily practice which would initiate learning of the relevant basic science knowledge (1). This is meant to create a cycle of learning and registrars are further expected to be able to regulate their learning process by correcting for factors which results in deviation from their original learning plan (1).

In order to map out a course for learning, the registrar needs to remain cognisant of the educational goals that need to be met (1). Broadly, these would include the requirements that should be met in order to achieve short- and long-term academic goals. These include all courses and degrees applicable to meet the requirements of professional regulatory bodies (1).

By successfully doing, reviewing, learning and applying, the registrar is expected to both enlarge and refine his expertise (3). The learning portfolio is meant to be the cornerstone in identifying gaps of knowledge through a system of ongoing review and reflection of learning experiences in a self-directed learning environment (1, 44).

Part of the anaesthesiologist's portfolio, or perhaps contractual obligation, may include being involved in the education and training of others (i.e. registrars, medical officers, interns, students). As a teacher, it is pivotal to grasp the context of the students' learning at different stages in their postgraduate training (1). For educators to better support the education of their students, the awareness that the way students learn and respond to their learning environment impacts on their learning approaches, plays an important role (97).

This support for learning may be achieved by interaction between the trainer (consultant) and the registrar on the various teaching and learning platforms that may be available, viz. encouragement of self-study, individualised clinical training, facilitated small group learning, small group tutorial teaching and the more didactic forms of teaching e.g. lectures and refresher courses (1).

2.8. Expertise, learning and the Studax

2.8.1. Expertise

Anaesthesiologists are considered experts in their field (1). Glaser (98) distinguishes "novice" and "expert" based on "the amount and internal organisation of the knowledge the latter uses in problem solving". This knowledge can be further distinguished into four kinds, viz.

- Declarative knowledge, which is based on the recall of factual information (21).
- Strategic knowledge, which indicates "what needs to be done especially if specific circumstances complicate the most obvious approach to solving the problem as it was originally conceived" (3).
- Procedural knowledge, which is a "compilation of declarative knowledge into functional units (or schemata) which incorporate domain specific strategies" (21, 99, 100).
- Situational knowledge, which is "knowledge about situations as they typically appear in a specific domain" (21) e.g. a diagnosis of a clinical condition based on a patient's presentation (3).

At this point, the difference between "learning" and "studying" should be noted. By "learning" a student mainly gains declarative knowledge (3). Declarative knowledge alone is insufficient in situations which require higher problem solving abilities and a deeper understanding. Therefore, incorporating the other three components in the attainment of knowledge is essential to the development of expertise (3).

Conversely, "studying" implies a continuum between attaining knowledge, assimilating that knowledge, and ultimately applying that knowledge by putting it

into practice (3). Without a thorough understanding i.e. memorisation without understanding, only surface-level learning is achieved (3).

2.8.2. A perspective on cognitive learning: Cognitive Load Theory

CLT is a theory about cognitive learning first described by Sweller (101, 102). CLT provides insight into why students in health professions fail to master more complex areas of expertise (99). Reasons for these may be that more complex tasks require "the simultaneous integration of multiple and varied sets of knowledge, skills and behaviours at a specific time and place" (99).

CLT assimilates the three key constituents of cognitive architecture (99). These are: memory systems i.e. sensory, working and long-term memory (LTM), learning processes and types of cognitive load imposed on working memory (WM) (99, 101-104).

CLT is based on Atkinson and Shiffrin's (105) 1960's model of human memory. This model states that "information enters the mind through the sensory memory system. This sub-system can simultaneously process vast amounts of visual and auditory information simultaneously, but retains the information for a very short period of time (milliseconds). Only information raised to the level of awareness enters the domain of working memory (WM). WM (re)organises the information so that it may be stored as packages in LTM. The LTM theoretically has an infinite capacity for storing information; however a route map is required to retrieve the desired information. The WM encodes the information with this route map to enable retrieval of the desired information" (99).

The rate of learning is limited by the fact that WM can process only seven (±2) elements of information at any given time (106). This has a negative impact on the ability of WM to construct and refine new schemata (i.e. the roadmap) and thereafter store to LTM (99). The definition of learning in this instance is "a change

in LTM" (107). As a result, learning is compromised when the cognitive load of the task is greater than the WM capacity of the learner (99).

The definitions of cognitive load according to CLT fall into three categories: intrinsic load, extraneous load and germane load. (99, 101-103). The intrinsic load is the load associated with the task, and is dependent on various factors (99). These include the individual's ability/proficiency, the number of information elements to be learned, and the inter-relativity of the elements associated with the task (99). In the case of studying, the intrinsic load would be related to the volume, complexity and inter-relativity of the detail in the material to be covered (99). There are only two ways in which the intrinsic load of a task can be altered: simplification of the task or enhancing the expertise of the learner through prior preparation. (99).

Extraneous load is defined as "the load on WM that is not essential to the task" (99). Examples of this would be when the information necessary for learning is scattered, thereby adding the task of searching for and having to collate information before learning can proceed; or when there is information overload through a single sensory channel instead of even distribution between the two (99).

In addition, presenting information via two modalities i.e. auditory and visual, without alignment between the two, results in impairment of both channels e.g. presenting slides that are full of information, but not allowing enough time to read them, compounded by a simultaneous verbal narrative that does not align with the visual slides (99).

Distractions while one is meant to be focusing are another example of extraneous load e.g. constant beeping of a pager, or background noise (99). Of importance is that intrinsic and extraneous load are additive in their demand on WM (99).

Extraneous load adversely affects learning if the intrinsic load of the task is already too high for the learner (99).

Germane load refers to "the load imposed by the mental processes necessary for learning" (99). This can be translated to "the level of concentration devoted to learning (as opposed to the task)". There will be not be sufficient WM resources available for the germane load necessary for learning if the intrinsic/extraneous load is too high and WM limit of the learner is approached or exceeded, e.g. building upon pre-existing schemata in LTM (99)

Effective learning occurs when the three components are regulated, such that extraneous load is minimised during task completion, tasks are simplified thereby decreasing the intrinsic load, and the germane load is optimised by the use of cognitive strategies that support schemata construction (99).

In the context of postgraduate learning in anaesthesiology, the contribution to the intrinsic cognitive load is two-fold: the first contributor is the cognitive load as reflected in the volume of material and knowledge that needs to be covered, as outlined by the syllabus (1). The second contributor is the intrinsic load imposed by the practical aspect of providing anaesthesia care. This highlights the greater demand for the germane load required to effect learning. The extraneous load is increased as the recommended resources necessary for learning is spread over a vast space, thus adding the task of searching for and having to collate information before learning can proceed.

This highlights the importance of sound preparation and study strategies in minimising extraneous cognitive load within the study environment, as well as managing the intrinsic load by possibly simplifying the work load into manageable portions. This can be facilitated by optimisation of the germane load by adopting approaches which include use of cognitive strategies that foster not only learning, but also understanding of the subject matter at hand (108).

2.8.3. The Studax

In his paper entitled "Studaxology: the expertise students need to be effective in higher education" Janssen builds upon the concept of "the studax" (3). That the way in which students tend or are inclined to approach their learning impacts their performance on assessments and eventual learning outcomes, is a concept that has received general acknowledgment (13, 33, 34).

Studaxology introduces this dimension to the learning strategies applied by students which stems from the students' understanding and regulation of their study behaviour. Janssen (3) identifies up to nine sources of variance for students' effectiveness in their study behaviours, starting with what he refers to as the "students' doings" as some of the determinants of study behaviour.

Table 2.1. Studaxology: determinants of study behaviour (3)

Studax	Meaning	Effort	Ability
Person	Intention/interest	Exertion	Self-confidence/success
Task	Time perspective	Discipline	Effectiveness & intrinsic motivation
Environment	Relevance	Demand/load	Difficulty

In the 3x3 matrix as illustrated in Table 2.1. (reproduced directly) Janssen further names three behavioural determinants of the "production process" (of expertise) that follows: "the person of the student, the task presented, and the area of study as the chosen environment" (3). The task governs the interaction between person and environment, which is in itself a continuously evolving process (3).

The second column relates to three types of "meaning" that are created. The first is "personal meaning" which arises from "intention or individual interest (and, by consequence, curiosity) creating unity and wholeness in the diversity of daily activities whilst studying" (3). The second meaning relates to the task to be

completed with respect to the "time perspective or agenda involved in its execution" (3). The third meaning refers to knowing "one's way to go" in the study environment i.e. finding a sense of direction or relevance in the chosen area of study (3).

In the next column, by analogy, three different kinds of "effort while working" are distinguished. Personal effort is labelled as "exertion" which "reflects the amount of personal energy and time to be spent in order to obtain personal control and grasp of what one is studying" (3). The effort required by the task itself is the "discipline" required both in terms of what needs to be done (studying) and how it ought to be done (efficiently) in order to effectively achieve one's goals. Lastly, the "environment" (the educational programme) impacts on what the students are expected to work out (3). Students' may differ in their psychological responses from a feeling of well-being to one of distress - the latter being a reflection of the demand of a high cognitive load (3).

The last column contains three distinct aspects of experiential behavioural capacity or "ability". The first is personal ability which is reflected in "feelings of self-confidence in succeeding" when one is expected to demonstrate proficiency in a learned task (3). In terms of studying, the outcome of assessment is expected to reflect one's ability (3). The ability in performing the task is gauged by the effectiveness and intrinsic motivation in completing the task. Intrinsic motivation in this context is described as "experiencing what one is doing as rewarding in itself" (3). Finally, ability in the case of the "environment" poses a challenge in terms of how difficult the student finds the area of study (3). This may pose a serious challenge when its nature significantly exceeds a student's ability (3).

To interpret study behaviour as an ongoing process there is a need for coordination and integration of the individual 3x3-specific experiences. This is significant as it will allow students to identify the deficiencies within their own frameworks of studying, as well as provide a handle on the cognitive load for

students to improve individual factors within the 3x3 matrix in order to become effective in their studying (3).

2.9. Learning styles and study behaviours

2.9.1. Learning styles

The concept of deep and surface approaches to learning (also called learning styles) was first described by Marton and Säljö (35) in Gothenburg in 1976. They analysed the quality of what students learned, in relation to the approach to learning they adopted (35, 52). They identified two patterns: the first, students who were identified as adopting the "deep approach" to learning showed intent to actively comprehend the author's meaning in what they read, and to relate new knowledge and ideas to their pre-existing knowledge and experiences. These students were found to not only have a more complete understanding, but also better factual recall both in the short and long term (after six weeks) (35, 52). In contrast, students who were identified as "surface learners" mainly identified and intended to memorise only those bits of information which they considered to be important for examination and assessment purposes. Their learning style was characterised by the use of rote learning and surface memorisation of facts, and in so doing, failed to fully grasp the content and deeper meaning of what they were studying (35, 52).

This concept of deep and surface approaches to learning was further investigated towards the early 1980s by Biggs in Australia (12) and Entwistle and colleagues in Britain (18). Biggs (12) identified and described three dimensions of the study process, viz. utilising, internalising and achieving orientations. Entwistle and colleagues (18) also identified three main types of learning orientations, and described these as "reproducing, meaning and achieving/strategic orientations". Both identified a strategic and motivational component behind each approach

(12, 18) . These differences in the study process are significant because they appear to have a direct relationship to the quality of the learning outcome (52).

The main characteristic of the surface approach is the use of rote learning and surface memorisation often of unrelated facts, with little intent of deeper understanding and application of concepts (52). Fransson (66) and Entwistle et al (18) showed that the group of students who adopt the surface approach to learning can further be divided into surface-active and surface-passive learners. This distinction is made on the basis of effort and involvement from the students. Surface-active learners may work hard to accumulate a substantial amount of factual information, but do not achieve more than a superficial level of understanding (18). Surface-passive learners in contrast, display little or no interest or effort in the subject, ultimately accumulating few and unrelated facts with little or no understanding of the subject (52).

The deep approach to learning on the other hand, stems fundamentally from the intention to understand (52). It should be noted however, that if the material to be studied is too complex or unfamiliar for the grasp of the learner, a deep level of understanding may still not be achieved (18). Students who adopt the deep approach are thought to a greater intrinsic interest in the subject matter, and as a result, spend more time in independent study (109). Pask (30) has identified operational learning and comprehension learning processes as two distinct processes used by students who adopt the deep approaches to learning. Both processes aim at understanding, but do so in different ways (30).

The operational learner practices on the basis of a "logical, step-by-step approach with a cautious acceptance of generalisations only when based on evidence" (30). Rote learning may be employed for learning of factual and procedural detail, particularly if there is pressure for time (30). The comprehension learner uses a process of approaching a topic broadly, initially focussing on the outlines of ideas and their relationship with other ideas and pre-existing knowledge (30). This is

characterised by attempting to understand the subject matter by the use of analogies and attachment of personal meaning (30).

A successful learner has the ability to be diverse and to use either approach as appropriate to a particular learning task (30). Students who are unable to do so and rely too heavily on either method are at risk of developing what Pask refers to as "learning pathologies", which seldom lead to a fully successful outcome (30).

In contrast to the learners adopting the deep approach to learning, "strategic" learners are influenced more by the "context than by the nature of the task itself" (52). This sometimes makes it difficult to distinguish strategic learners from either deep or surface approach learners, because they use whichever approach they believe will enable them to perform well on assessment measures (110). This may result in them using a variety of other strategies to meet this objective, e.g. "spotting" from past examination papers, seeking hints from teachers or senior colleagues, and some may go as far as to try and impress those they believe may be involved with their assessment (110).

Thus, strategic learners may approach their studies with great versatility, however the primary intention being successful performance on assessment tasks rather than aiming for a deep level of understanding (52).

2.9.2. The Approaches and Study Skills Inventory for Students questionnaire

The ASSIST is a self-administered questionnaire which was developed by Tait & Entwistle from an earlier research tool, the Approaches to Studying Inventory (ASI), with the intention to help identify "students at risk through ineffective learning strategies" (48, 111). The basis of the ASSIST questionnaire stems from earlier works by Marton & Saljö and others (12, 35, 62). It provides a description of students' learning styles together with their study strategies, and was designed to "indicate the relative strengths of students' approaches to learning in three main

scales/constructs: deep, surface and strategic – all of which are thought to contribute to concretely different learning outcomes" (48, 49).

The ASSIST questionnaire comprises three sections. Section A consists of six items relating to the student's perceptions of learning, Section B (referred to as the Revised ASI) is a revision of the ASI which contains 52 items (112), and a shortened version of 18 items (known as the ASSIST short-form) has also been validated and used independently or in conjunction with other items (48, 64). In this inventory, each main construct (deep, surface and strategic learning approach) has sub-scales which are related to the main approach (48). Each approach to learning comprises four or five sub-scales and each sub-scale comprises four items. This is shown in Table 2.2. Section C is an eight item questionnaire which measures preferences for different kinds of teaching.

Table 2.2. Learning styles and their constituent sub-scales (reproduced from the ASSIST questionnaire) (48)

Deep	**Surface**	**Strategic**
Seeking meaning*	Lack of purpose	Organised studying
Relating ideas	Unrelated memorising	Time management
Use of evidence	Fear of failure*	Achieving*
Interest in ideas*	Syllabus-boundness	Alertness to assessment demands
Monitoring effectiveness (also loads on strategic)		
***motivation-related sub-scales**		

A five-point Likert scale is used to measure attitudes where students rate the extent of their agreement with a series of related items that cover the aspects of a specific construct viz. deep, surface and strategic approaches to learning (48, 64). Sub-scale scores are formed by adding together the responses on the items in

that sub-scale (48). Scores on the three main approaches are created by summing the sub-scale scores which contribute to each approach (48).

Validity of the ASSIST questionnaire

The validity of the ASSIST questionnaire has been established in several studies (48, 64, 113-115). Factor structure analyses were also conducted and the conclusion was that some factor loading was population dependent and should be assessed for each population independently (60, 64, 114) .

Studies conducted using the ASSIST questionnaire

The ASSIST questionnaire has been used and validated in studies conducted at various levels of education, from high school through to higher education and across a wide range of educational disciplines (49, 60, 64, 111, 113, 116). Apart from providing a description of the particular learning styles prevalent within a population, studies using the ASSIST questionnaire have investigated differences in learning styles based on a range of factors, which are discussed as follow (72, 97, 112, 117, 118).

Comparisons based on age/maturity

Studies conducted by Richardson (112) and Harper & Kember (117) compared the effect of age on learning approaches used by students. Their findings were consistent with one another, which showed that mature students (defined as an age greater than 23 years) scored higher on the deep approach and lower on the reproducing/strategic approach to learning. Harper & Kember (117) found that there was a significant relationship between increasing age and the tendency to adopt a deep approach to studying, better relating of ideas as well as greater intrinsic motivation. Age also had a negative correlation to syllabus-boundness. These findings were further supported in a study (97) that assessed Turkish and American students' approaches to study. They showed that advancing school year as a surrogate for maturity is a factor which may influence a student's approaches

to learning (97). They found that students adopted surface learning approach less and become more meaning orientated as school year increased (97) .

Comparisons based on gender

Differences in learning approaches on the basis of gender were also found in a study conducted in Turkey (97) which showed that females tend to adopt strategic approach more than males. However, this finding was contrary to the findings from an Australian study (49) which showed males producing significantly higher scores on strategic approach, whereas another study conducted in Sri Lanka amongst 364 undergraduate and postgraduate medical students showed no significant differences in the approach to learning between male and female students (118).

Comparisons based on subject/discipline

Smith et al (72) noted in their study involving 248 economics, computing and psychology students that there was a relationship between discipline and approach to learning. Psychology students scored higher on deep approaches, while economics and computing students scored lower on deep approached and higher on surface approaches. This is in keeping with the findings found in a study that assessed the learning approaches of 103 first year BSc students who were enrolled in an introductory course in chemistry (49). The findings showed a consistent preference for surface learning, with the strategic and deep learning styles attracting lower scores. This preference for surface learning was suggested to not necessarily be due a lack of interest in chemistry, but the content may have not been central to the students' interests as chemistry was not their major (49).

Effect of learning environment on learning approaches

One recent study conducted in Indonesia (119) assessed the effect of the educational environment on the approaches to learning amongst 232 nursing students. The study attributed the high scores achieved for strategic and deep learning approaches to the implementation of problem-based learning.

Mode of assessment and approaches to learning

Most students define what they want to achieve by entering higher education implicitly: an acknowledged "master" of a well-defined occupational domain (3) i.e. an expert in that domain e.g. anaesthesiology. This mastery is demonstrated by the students' ability to provide "effective and creative solutions to problems in that domain", in both a scientific and socially acceptable manner through formal assessment procedures (3). Elton and Laurillard (23) wrote in 1979, that "the assessment system is the most potent factor influencing student learning behaviour". Marton and Säljö (62) agreed and added that "the assessment process does not only profoundly affect the knowledge and skills the students acquire, but it also influences the student's approach to learning". This concept is supported by findings from work done by Ramsden (120) and others (33, 121, 122).

In an aligned curriculum, the assessment tasks should be appropriate in measuring the students' actual learning outcomes (4). Newble and Entwistle (52) observed that in many undergraduate medical education programmes, the assessment schemes "fail to evaluate many of the most important curriculum objectives. All too often examinations evaluate little more than recall of factual knowledge". This may induce and reinforce the employment of the surface approach and rote learning, even in students who prefer a deep approach, particularly if the volume to be learned is too great (52).

Scouller (34) conducted a study to assess the influence of the method of assessment on the learning approaches amongst second year education students. The findings of the study shed light on the relationships between students' learning approaches and their perceptions of the levels of intellectual abilities specifically in the case of multiple-choice questions (MCQ) examinations and assignment essays. Scouller's study (34) also noted the students' preference for method of assessment (MCQ versus assignment essay) and the respective performance outcomes in each.

Despite students being versatile in their study approaches and strategies in different situations (123), Scouller (34), like Thomas and Bain (124), found that "students were significantly more likely to employ surface learning approaches (surface strategies and surface motives) when preparing for their MCQ examination and deep learning approaches (deep strategies and deep motives) when preparing their assignment essays" (34). This finding is consistent with a larger body of research (33, 120-122) which has demonstrated students' use of surface learning approaches for MCQ-based examinations.

However, in their study involving 248 undergraduate students Smith et al further showed that the mode of assessment (MCQ vs. essay questions) had no impact on the approaches to learning (72).

Scouller's findings (34) regarding the students' perceptions of the MCQ examination versus assignment essay was in keeping with Tang's (123) findings i.e. the perception that MCQ examinations assess knowledge-based or lower levels of cognitive processing, whereas the assignment essay assess higher levels of intellectual skills and cognitive abilities such as analysis, application and comprehension.

With regard to assessment outcomes, both Scouller and Tang (34, 123) found there was a positive association of higher assignment essay marks with the employment of deep learning approaches, and a negative association with surface strategies and motives. These results are further underpinned by the finding of the lowest marks on the assignment essay being associated with students' employment of surface strategies during their preparation (34). Multiple regression analysis in Scouller's study further suggests that the use of learning approaches other than deep learning may lead to better performance scores on MCQ examinations (34).

A pitfall of Scouller's study (34) however, was that the essays were assignments as opposed to the MCQ's which were answered under test conditions. This may have

influenced the approaches to studying, as Smith et al (72) showed that substantial pressure to complete a complex task in a limited amount of time may result in a decreased tendency towards deep learning. Fransson (66) supports this, and adds that students tend to adopt the surface approach to learning if they perceive the task as irrelevant or if it induced anxiety. These factors induced students who would normally adopt a deep approach to studying, to now adopt the surface approach (66).

The prescribed curriculum in a anaesthesiology emphasises deep learning from students, in order to foster a more complete understanding as well enable the recall of more factual details both in the short and long term (35). Instead, students may be strongly encouraged to employ surface or strategic learning methods in an attempt to handle the immense cognitive load such a vast, unweighted syllabus is bound to impose (18, 36-38).

2.9.3. Study behaviours

Review of the medical education literature revealed that study behaviours of medical registrars/residents across disciplines have not been documented extensively. Internationally, few publications (25, 40, 54, 125) have been identified which address study behaviours employed by registrars/residents in their training.

Numerous studies (25, 40, 125-127) have been conducted amongst surgical residents to investigate factors and interventions which may have had an effect on their performance on the American Board of Surgery in-training examination (ABSITE). One such study (40) included 51 residents who completed questionnaires providing information regarding the ABSITE examination. The questionnaires included information about their previous ABSITE performance, anxiety, amount of time spent studying, amount of sleep before the examination, confidence, and attendance at conferences. The data showed that the combination of conference attendance (26.3%), amount of sleep (9.8%), and amount of study (8%) were responsible for 71% of the variance in ABSITE scores.

Furthermore, the amount of study and conference attendance were significantly correlated with ABSITE performance (40). Other studies (125-127) within the general surgical discipline had shown that weekly reading assignments and examinations also had a positive impact on sustained improvement in ABSITE scores.

The aim of one study (57) conducted amongst 57 general practice registrars, who had a minimum experience of six months, was to evaluate the registrars' preferences for learning experiences. The study found that while registrars had a wide range of learning styles and learning preferences, they preferred interactive learning with feedback, but still valued more passive methods of learning (57). Of the registrars who responded, 71% found formal lectures helpful, while more registrars found tutorials (95.2%), discussion of problems with their trainer (90.5%), study groups (88.1%) and problem-solving sessions (88.1%) to be helpful to their learning. The findings of this study also showed that 78.6% of registrars felt that learning should be a self-directed activity (57).

Another study (54), which was conducted amongst 72 family medicine residents, aimed to determine their learning behaviour and preferences outside of hospital settings in an attempt to help guide the development of an improved, more effective adult educational programme. The findings showed that overall, all physicians engaged in a variety of educational activities e.g. attending staff physicians' teaching sessions, participating in conferences, courses, or workshops and in postgraduate medical education sessions. However, self-study was the primary learning preference of most residents (67%), and textbooks (26%), medical journals (20%), and point-of-care resources (12%) were the three most commonly-used self-study resources (54).

Salient points arising from this study highlight the need of both the "scholar" and the "educator" to be cognisant of differences in individuals' learning styles and study behaviours, particularly in the setting of adult learning (54). The study

further recommends that residency programs could be more supportive of residents' learning preferences by offering flexibility in the methods and delivery of teaching, as well as within the educational environmental setting citing that "such programs would provide opportunities for residents to develop self-directed learning skills" (54). This is relevant as the study found that didactic teaching modalities are neither the students' preferred nor their only learning preference (57) and as adult learners, they are capable of managing their own learning processes. (54, 96).

Finally, emphasis and support for residents improving their self-directed learning skills and learning behaviour during residency training lays the foundation for life-long learning (54). This is supported by the study (25) which investigated factors affecting performance in the ABSITE, where the authors write:

> "It is in the interest of program directors of surgery to identify those aspects of their own programs that will lead to resident improvement in each of these areas for their residents. When the residents are in an environment that promotes and nurtures learning, they will not only perform well on the ABSITE, but also hopefully develop the knowledge, skills, and attitudes that will make them better surgeons."

2.10. Complexity: The life of a registrar

Dewey (42, 43) has defined a "problem" as the discrepancy between what ought to be and what is. The question of medical postgraduate students' less-than-satisfactory performance in primary and certification examinations, is one that has been investigated by various disciplines in the past (2, 24, 25, 27, 31, 39-41). However, attempting to understand a student's academic or professional performance in isolation without attempting to understand the factors that influence the student's performance has been compared to examining a patient's compliance to treatment without trying to understand the context of the individual (27).

In a focused literature review conducted by Mitchell et al (27) in 2002-03, the authors elucidated on a variety of factors which have been found to impact residents' job performance. They had further developed a theoretical model based on three input factors affecting residents' performance: individual resident factors, health care infrastructure and medical education infrastructure. The contribution of the learning and educational factors that may affect performance has been discussed in depth. Studies conducted by Mitchell et al and others (27, 128) add value by highlighting the other factors which should be considered when attempting to account for a student's professional – and as an extension – academic performance. These factors are highlighted in Table 2.3.

Table 2.3. Factors affecting residents' professional performance (27)

Factors affecting residents' professional performance	Findings of studies
Personality (4 studies)	Introversion and flexibility (defined as "liking variety and change, and being easily bored") were personality traits associated with poor performance.
Social factors (8 studies)	There was an inverse correlation between the presence of a social support system and job stress.
Personal health:	
Mental health (20 studies)	Depression, burnout, mood states anger-hostility, fatigue-inertia, tension-anxiety had a negative impact on performance.
Physical health (1 study)	Relationship to performance not examined
Financial stress/debt (1 study)	Lack of financial stability was a major source of stress.

2.11. Summary

A review of the literature has been presented as it pertains to the postgraduate terrain in anaesthesiology in South Africa, the roles and competencies of the anaesthesiologist, the development of expertise and the role of basic sciences knowledge in anaesthesiology. The cognitive load theory of learning as well as learning styles and study behaviours have been discussed amongst factors which may impact registrars' academic performance. The following chapter will explain the methodology behind the study design.

Chapter 3 | Research Methodology

3.1. Introduction

This chapter will comprise the problem statement, aim and objectives of the study, the ethical considerations, as well as the research methodology used, including the measures taken to ensure the validity and reliability of this study.

3.2. Problem statement

There are minimum requirements that need to be met on the road to qualifying as a specialist in anaesthesiology (44). Apart from the basic science and clinical knowledge-based assessments that need to be passed, there are also non-clinical competencies that the postgraduate student in anaesthesiology has to master (1, 45). One such competency involves the anaesthesiologist's role in self-education and the education of others in the form of an" exemplary scholar and teacher" (1).

The guidelines to achieving the objectives of the postgraduate training programme in anaesthesiology are set out within the published regulations and curriculum of the CMSA and CA (CMSA) respectively (1, 44). From the perspective of CA (CMSA) and the training institutions, these objectives should be realised through self-directed education and learning on the part of the student. Self-directed or problem-based learning has shown success in some instances of postgraduate training in anaesthesiology (9). If done correctly, with constructive alignment within the learning system, students are said to become "entrapped in a web of consistency," thereby increasing the likelihood of students engaging in the appropriate learning activities needed to achieve the desired learning outcome (5).

On paper, the prescribed curriculum in anaesthesiology in South Africa satisfies the criteria of a problem-based curriculum. On paper, there appears to be some degree of constructive alignment within the system. However, the results of the primary examinations in anaesthesiology seem to suggest otherwise.

The national pass rates for the FCA (SA) Part I examinations from March 2010 to March 2014 have averaged at 50% with the results in the March 2014 sitting reaching a near all-time low, with a national pass rate of 42% (10). Results from the Master of Medicine (MMed) in the branch of Anaesthesiology primary examination are comparable, if not worse. This is alarming and a definite cause for concern - both for the trainees as well as the training institutions.

The individual reasons behind the failure of a student may be complex (46, 47). However, in view of the fact that on average, only 50% of the candidates that attempt the FCA Part I examinations in anaesthesiology are successful, one does not get the impression that those students are "entrapped in a web of consistency" where their engaging in appropriate learning activities is inevitable.

This raises an important question: how are these candidates preparing for the examination? It has been shown in the literature that the way students learn impacts their outcomes in assessments (3, 5, 12, 14, 16, 22, 24-32). Granted, there may be several factors which influence their approach to learning (27, 39, 46). However, a closer assessment of the study styles and strategies candidates use in their preparation for the Part I examination may shed some light on the differences in the positive and negative outcomes of the examination.

3.3. Aim of the study

The aim of this study was to describe the learning styles and study behaviours of anaesthetists in the postgraduate programme at Wits, particularly in the context of their preparation strategies for the Part I examination.

3.4. Objectives of the study

The aim of this study was achieved by means of the following objectives.

Primary objectives:

- to describe the perceptions of learning amongst the anaesthetists

- to describe the learning styles amongst the anaesthetists using the ASSIST questionnaire
- to describe the use of learning and study strategies amongst the anaesthetists using the ASSIST questionnaire
- to describe the study behaviours of the anaesthetists in preparation for the Part I examination
- to describe the challenges faced by the anaesthetists with regard to their preparation for, as well as with the Part I examination itself.

Secondary objectives:

- to compare the learning styles of the anaesthetists according to the ASSIST based on their gender
- to compare the learning styles of the anaesthetists according to the ASSIST based on their number of attempts at the Part I examination
- to describe the study behaviours of those anaesthetists who were successful on their first attempt at the Part I examination.
- to describe the suggestions made by the anaesthetists on how the Department of Anaesthesiology may improve its support of teaching and learning for the Part I examination.

3.5. Ethical considerations

The proposal for this study was submitted for approval to the Wits Graduate Studies Committee (Appendix A) and Human Research Ethics Committee (Medical) (Appendix B). Permission to use the ASSIST questionnaire was granted by the authors (Appendix C)

An information sheet (Appendix D) prefaced each data collection sheet (Appendix E) and served to introduce the study topic, detail the aim and ethical considerations of the study, and invite the anaesthetist to participate in the study.

It was further stated in the information sheet that participants were free to withdraw from the study at any point, with no repercussion. Return of a completed data collection sheet was regarded as implied consent by the participant.

Given the sensitive nature of the data collected, names and other specific identifiers did not form part of the data collection sheet, thereby maintaining anonymity. Participants were given the option to omit any questions they felt may identify them. This was stated on the information sheet attached to questionnaire.

Completed questionnaires were returned in an unmarked, sealed envelope directly into a sealed box which was opened at the end of the data collection period.

Only the researcher and the respective supervisors had access to the raw data in order to maintain the confidentiality of the participants. The data collected will be stored securely for six years after the completion of the study.

Participants, who were concerned about their learning style or study strategies, would have been referred to the Department of Anaesthesiology Wellness Committee for appropriate referral.

This study was conducted in accordance with the principles of the Declaration of Helsinki (129) and the South African Good Clinical Practice Guidelines (130).

3.6. Research methodology

3.6.1. Study design

A prospective, cross-sectional, contextual, descriptive study design was used in this study.

A prospective study is one where data is collected during the course of the study (131). This study was prospective in that a group of anaesthetists were identified for study and the data was collected from them during the course of the study.

A cross-sectional study design examines variables within groups of subjects at different stages of development and over a limited period of time, with the intention of identifying trends over time (132). This study evaluated the study behaviours of a group of anaesthetists who were at different stages in their training.

A contextual study investigates variables in a limited field or area (131). The contextual design of this study described data in a limited system i.e. a specific group of anaesthetists in a specific institution i.e. Wits. Therefore, the findings of this study may not apply or extrapolate to other settings or populations.

A descriptive study provides new information on a phenomenon. The aim is to obtain complete and accurate information through observation, description and classification. A descriptive study design implies that study variables are defined and then described (131). This was a descriptive study as it provides new information on the study variables as outlined in the study objectives.

3.6.2. Study population

The study population comprised all anaesthetists who were on the Wits circuit at the time of the study, who had attempted the Part I examination from 2010 to 2015.

3.6.3. Study sample

Sample size

The questionnaires were administered to the entire accessible population of 107 anaesthetists. The sample size was determined by the response rate. A response rate of at least 60% was considered acceptable (133).

Sampling method

A purposive sampling method was used in this study. This sampling method allows the researcher to "include participants with key experience of the issue to

be studied" (134). The decision on whom to sample was taken before the commencement of data collection.

3.6.4. Inclusion and exclusion criteria

Anaesthetists on the Wits circuit who had attempted the Part I examinations from 2010 to 2015 were included in the study. Anaesthetists who chose to not participate in the study were excluded.

3.7. Data collection

3.7.1. Data collection instrument

The researcher reviewed literature that has been published on this topic, and compiled a questionnaire (Appendix E) based on the validated ASSIST questionnaire in consultation with an expert in the fields of Anaesthesiology and Medical Education. This ensured face and content validity. Permission was granted by the author to use the ASSIST questionnaire (Appendix C). The factor-structure of ASSIST is well-defined and has been validated with other populations and at different levels of education (61, 64, 113, 114). The factor structure provides well-established analytic categories which describe general tendencies in studying and their correlates (48). The ASSIST questionnaire has been discussed in more detail in the literature review.

The questionnaire used in this study comprised of four sections:

- The first section addressed the demographic and academic background of the participants.
- The second section addressed the participants' individual experiences of the Part I examination, including their preparation strategies and the subsequent outcomes.
- The third section addressed the learning styles and study strategies of the participants, based primarily on the short form of the ASSIST questionnaire,

with the addition of seven questions from the original version of the ASSIST questionnaire.

- There were 25 items assessing the deep, strategic and surface learning approaches as well their sub-scales, as shown in Table 3.1. and each item carried a maximum score of 5.
- The final section of the questionnaire evaluated the participants' perceptions of learning.

Table 3.1. ASSIST learning styles and their composite sub-scales used in this study

Learning Style	Sub-scales
Deep (4 items)	Relating ideas (3 items) Seeking meaning (1 item)
Strategic (10 items)	Organised studying (3 items) Time management (3 items) Monitoring effectiveness (1 item) Achieving (3 items)
Surface (11 items)	Unrelated memorising (3 items) Syllabus-boundness (2 items) Lack of purpose (2 items) Fear of failure (4 items)

3.7.2. Data collection method

An up to date list of the names of all anaesthetists eligible to participate in the study was compiled with assistance from the Department of Anaesthesiology prior to the data collection period. These anaesthetists were sought at the various training sites and invited to participate in the study, where the questionnaires

were distributed to those who agreed to participate. The participants were allowed to complete the questionnaires at their convenience, and were reminded to return the questionnaires. Once completed, participants returned the questionnaires to a sealed box which was placed at each site for the duration of the data collection period. Data were collected from December 2015 to July 2016. At the end of the data collection period, the Department of Anaesthesiology provided relevant background information regarding the first-attempt pass rate of the study population, while preserving the anonymity of the individual.

3.7.3. Data analysis

The data collected were entered in a Microsoft® Excel spreadsheet for review and analysis in consultation with a biostatistician using Statistica® version 12. Descriptive and inferential statistics were used to report the results of the study. Continuous variables and scores of the ASSIST portion of the questionnaire were summarised using percentages and means and standard deviations or medians and ranges as appropriate. The Shapiro-Wilks test was used to determine whether data were parametric or non-parametric. The Mann-Whitney and unpaired t-tests were used for comparisons, both taking unequal variances into account. A p-value of <0.05 was considered statistically significant.

3.8. Validity and reliability

Validity as defined by Botma et al (135) "indicates whether the conclusions of the study are justified by the design and interpretation." The reliability of the study is a representation of the consistency of the measure achieved. i.e. if a valid measuring instrument is applied to a different group under different circumstances, it should produce the same results (135). The validity and reliability of this study was ensured by:

- having a representative sample size, with the sample size being close to the population size

- using an appropriate study design and data gathering techniques
- the researcher being the only data collector
- using a previously validated questionnaire
- inviting all eligible anaesthetists to participate thereby minimising selection bias
- analysis of data in consultation with a biostatistician.

3.9. Summary

In this chapter the problem statement, aim and objectives, ethical considerations, research methodology, data analysis and validity and reliability were discussed. In the next chapter the results of the study are reported and discussed.

Chapter 4 | Results & Discussion

4.1. Introduction

In this chapter, the sample realisation and the results of the study are presented according to the objectives, followed by the discussion. The objectives of this study are therefore repeated.

Primary objectives:

- to describe the perceptions of learning amongst the anaesthetists
- to describe the learning styles amongst the anaesthetists using the ASSIST questionnaire
- to describe the use of learning and study strategies amongst the anaesthetists using the ASSIST questionnaire
- to describe the study behaviours of the anaesthetists in preparation for the Part I examination
- to describe the challenges faced by the anaesthetists with regard to their preparation for, as well as with the Part I examination itself.

Secondary objectives:

- to compare the learning styles of the anaesthetists according to the ASSIST based on their gender
- to compare the learning styles of the anaesthetists according to the ASSIST based on their number of attempts at the Part I examination
- to describe the study behaviours of those anaesthetists who were successful on their first attempt at the Part I examination.
- to describe the suggestions made by the anaesthetists on how the Department of Anaesthesiology may improve its support of teaching and learning for the Part I examination.

4.2. Sample realisation

A total of 114 anaesthetists were identified as potential participants for the study. However, only 107 anaesthetists were invited to participate over the eight month period, as the remaining 7 anaesthetists could not be reached due to being on leave, etc. The total number of questionnaires returned was 85, of which 5 were blank and 2 were largely incomplete. Only 78 completed questionnaires were deemed suitable for data analysis. This constituted a 72.9% response rate and was therefore considered an adequate representation of the study population. With the aid of the department, the response rate was further defined for those who passed on first attempt (n=55; response rate 79.7%), as well as for those who attempted the Part I examination more than once (n=23; response rate 60.5%). Therefore, both groups were considered to be adequately representative of the study population. This is further detailed in Table 4.1.

Table 4.1. Sample realisation

Anaesthetists on Wits circuit	**Study population**	**No. invited** (%)	**No. not reached** (%)	**Response rate** n (%)
Eligible to participate	114	107 (93.9%)	7 (6.1%)	78 (72.9%)
Passed on 1st attempt	72	69 (95.8%)	3 (4.2%)	55 (79.7%)
Unsuccessful on 1st attempt	42	38 (90.5%)	4 (9.5%)	23 (60.5%)
1st attempt pass rate	63.2%	64.5%	42.9%	70.5%
1st attempt failure rate	36.8%	35.5%	57.1%	29.5%

4.3. Results

Descriptive and inferential statistics are used to present the data and percentages are rounded off to one decimal place.

4.3.1. Demographics

The demographic data will be presented in terms of personal, educational and professional demographics. Demographics related to the outcomes of the Part I examination will also be presented.

Personal and educational demographics

The median age at first attempt at Part I amongst the anaesthetists was 30 (IQR 29-31) years. Table 4.2. shows the personal demographics of the anaesthetists.

Table 4.2. Personal demographics of the anaesthetists

Gender	n (%)	**Home languages**	n (%)
Male	31 (39.7%)	**English**	49 (62.8%)
Female	47 (60.3%)	**Afrikaans**	13 (16.7%)
		African language	8 (10.3%)
		Other/not specified	8 (10.3%)
Ethnicity	n (%)	**High school attended**	n (%)
White	36 (46.2%)	**Public school**	54 (69.2%)
Black	13 (16.7%)	"Traditional"	34 (63%)
Indian	13 (16.7%)	Ex-model C	18 (33.4%)
Asian	4 (5.1%)	Rural	2 (3.7%)
Coloured	2 (2.6%)	**Private school**	23 (29.5%)
Other	10 (12.8%)	**Undisclosed**	1 (1.3%)

Undergraduate education

Most of the participants qualified between the years 2006-2008. All South African universities that provide undergraduate medical education were represented within the study sample. Thirty five (44.9%) participants were Wits' graduates and they comprised the majority.

Other qualifications outside of Medicine

Of the anaesthetists, 65 (83%) had no other qualification outside of medicine. Of those with other qualifications, 3 (23.1%) had finance/management qualifications while 10 (76.9%) had Bachelor of Science or Health Science degrees.

Professional demographics

Anaesthetists of all designations were represented in the study sample. The designation, as well as the median number of years of experience the anaesthetists had in providing anaesthesia care, is shown in Table 4.3.

Table 4.3. Professional demographics of the anaesthetists

Designation	**Anaesthetists** n (%)	**Years of experience Median (IQR)**
Junior consultant (JC)	24 (30.8%)	6.5 (5-7.6)
Senior registrar (SR)	27 (34.8%)	4.75 (4-5)
Junior registrar (JR)	25 (32.1%)	3 (2.9-4)
Medical officer (MO)	2 (2.6%)	4.75 (3.1-6.3)

The median (IQR) number of months of training completed by the registrars at the time of answering the questionnaire was 26.5 (17.3-38.8) months. All senior registrars had completed both the neurovascular and cardiothoracic anaesthesia rotations, whereas 19 (76%) junior registrars had not yet completed the

neurovascular anaesthesia rotation. This is relevant as substantial revision and application of basic sciences knowledge is required in these rotations.

Demographics related to the outcomes of the Part I examination

Table 4.4. summarises the participants' Part I examination outcomes.

Table 4.4. Outcomes of the Part I examination (FCA and MMed)

Outcomes of the Part I examination based on subjects		
Number of attempts to success	**Anaesthetists** n (%)	**Subject** n (%)
1	55 (70.5%)	n/a
2 - rewrite of 1 subject	7 (9%)	Physiology: 2 (28.6%) Physics: 5 (71.4%)
2 - rewrite of all 3 subjects	6 (7.7%)	n/a
> 2	2 (2.6%)	n/a
Outcomes based on semester		
Semester	**Anaesthetists** n (%)	**1st attempt pass rate** %
First (March)	28 (25.9%)	75%
Second (August/December)	45 (57.7%)	71%

Table 4.4. cont. Outcomes of the Part I examination

Outcomes based on FCA (SA) vs. MMed Part I examination		
Part I Examination	**Anaesthetists** n (%)	**Outcomes** n (%)
FCA	71 (91%)	53 (74.6%) passed on 1st attempt
MMed	3 (3.8%)	2 (66.7%) passed on 1st attempt
MMed then FCA	3 (3.8%)	3 (100%) were unsuccessful on 1st attempt (MMed), but successful on 2nd attempt (FCA)
FCA then MMed	1 (1.3%)	Unsuccessful on >2 attempts at FCA, but successful on 1st attempt at MMed

4.3.2. Primary objectives

Primary objective 1: to describe the perceptions of learning amongst the anaesthetists

More than 80% of the anaesthetists identified closely or very closely with the statements on their perceptions of learning, which were adapted from Section A of the ASSIST questionnaire. The six-item measurement relating to the student's perceptions of learning is shown in Figure 4.1.

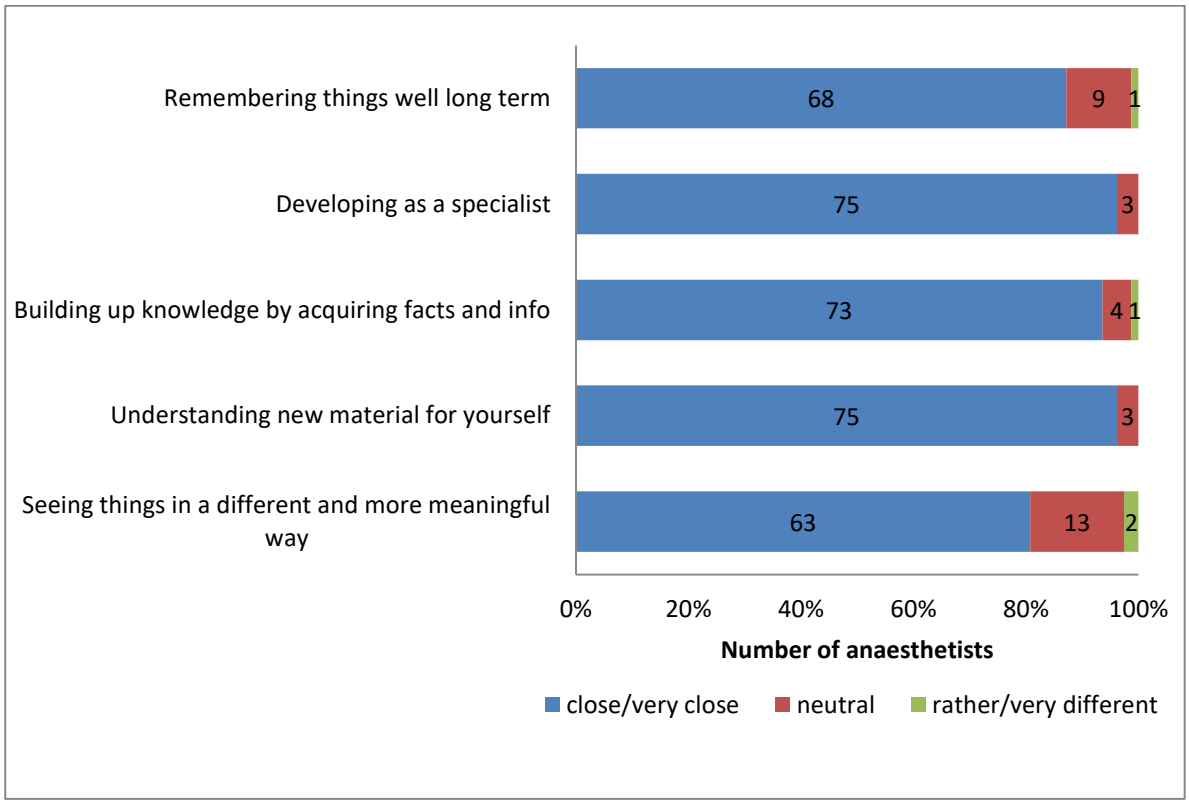


Figure 4.1. Perceptions of learning amongst the anaesthetists based on statements from the ASSIST questionnaire

Primary objective 2: to describe the learning styles amongst the anaesthetists based on the ASSIST questionnaire

Each item on the ASSIST portion of the questionnaire asks for agreement or disagreement with the statement on a Likert scale of 1 – 5. Each item carried a maximum score of 5. The highest score was attained by the anaesthetists was for the deep learning approach, followed by the strategic learning approach, with the lowest score being for the surface learning approach. This is demonstrated in Table 4.5.

Table 4.5. Learning styles of the anaesthetists based on the ASSIST questionnaire

Learning Style	**Mean/Median** (%)	**SD/IQR** (%)
Deep **(4 items)**	14 (70%)	13.3-15.8 (66.3-78.8%)
Strategic **(10 items)**	33.9 (67.8%)	8.1 (16.1%)
Surface **(11 items)**	33.4 (60.6%)	7.6 (13.7%)

Primary objective 3: to describe the use of study strategies amongst the anaesthetists using the ASSIST questionnaire

Table 4.6. summarises the anaesthetists' use of study strategies as described in the ASSIST questionnaire. Each item carried a maximum score of 5.

Table 4.6. Anaesthetists' use of study strategies based on the ASSIST questionnaire

Study strategy	Mean/Median	SD/IQR
Relating ideas (3 items)	10	10 - 12
Seeking meaning* (1 item)	4	3 - 4
Organised studying (3 items)	10.1	2.8
Time management (3 items)	9.9	3.3
Monitoring effectiveness (1 item)	4	3 - 4
Achieving* (3 items)	10	9 - 12
Unrelated memorising (3 items)	8.5	2
Syllabus boundness (2 items)	5.4	2.2
Lack of purpose* (2 items)	5.5	2.6
Fear of failure* (4 items)	14	3.4
***motivation-related sub-scales**		

Primary objective 4: to describe the use of preparation strategies for the Part I examination as reported by the anaesthetists

The anaesthetists described their study behaviour in preparation for the Part I examinations in relation to their broad study plans and their consistency in adhering to said study plan, their strategies relating to time management, use of personal study aids, and the availability and usefulness of departmental various departmental teaching modalities.

Broad study plan and consistency

The study plans described by the anaesthetists were used as a surrogate to assess their awareness of how they approach their studying. One point was awarded per statement provided in the outline of the study plan, as shown in Figure 4.1. and Table 4.7. Components of the anaesthetists' study plansillustrates the components included in the study plans described by the anaesthetists. In response to the question about whether they were consistent in following their study plan, 20 anaesthetists (25.6%) responded "yes", 37 (47.4%) found it challenging but managed to be consistent and 21 (26.9%) responded "no".

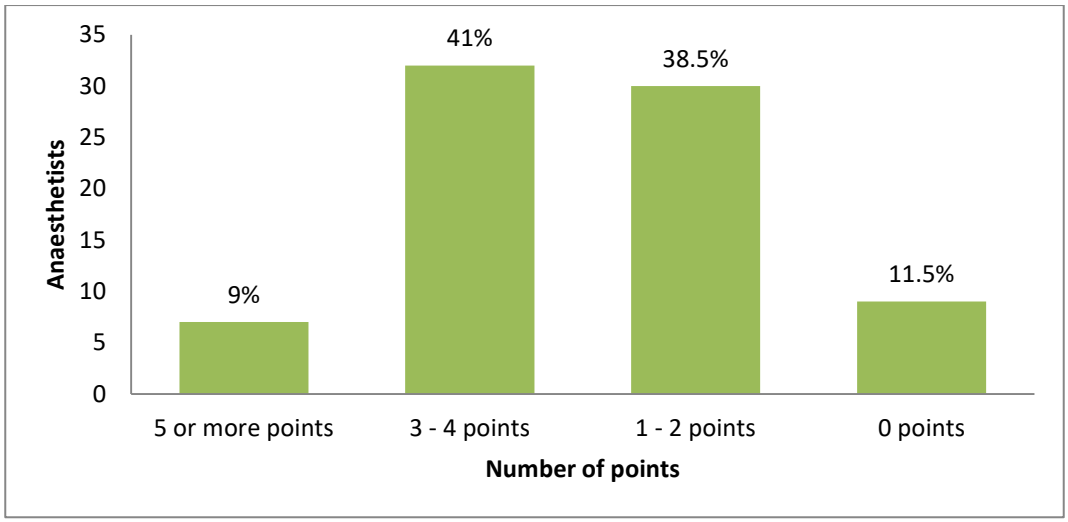


Figure 4.1. Scoring of the anaesthetists study plans according to the amount of detail provided

Table 4.7. Components of the anaesthetists' study plans

Component of study plan	**Anaesthetists** n (%)
Curriculum	9 (11.5%)
Collate resources	7 (9%)
Study timetable	9 (11.5%)
System-based approach	6 (7.7%)
Subject-based approach	10 (12.8%)
Time-management strategies	20 (25.6%)
"Study"	24 (30.8%)
Specification of resources used	40 (51.3%)
Revision and repetition	18 (23.1%)

Time management strategies

There were 71 (91%) anaesthetists who first attempted the Part I examination during their registrarship, of whom 51 (71.8%) passed on first attempt. Five (6.4%) had written as medical officers prior to entering the postgraduate programme, of which 3 (60%) were successful on their first attempt. Two participants did not disclose whether they were already registrars when they first attempted the Part I examination, one of whom had passed on the first attempt.

The median (IQR) number of months into registrarship at which the anaesthetists first attempted the Part I examination was 14 (10.5-18) months. On average they had prepared for 8.6 (SD 3.4) months prior to the examination, whilst maintaining a full-time job. Seventy three (93.8%) anaesthetists reported making use of an "intensive study period" closer to the examination. Of those who utilised an intensive study period, 37 (50.7%) typically studied intensively for 3-4 hours per day for an average of 3.6 (SD 2) months. This is shown in Table 4.8.

Table 4.8. Time management during intensive study period

Time spent studying (hours per day)	**Months** mean/median (SD/IQR)	**Anaesthetists** n (%)
1 - 2	4 (2.5)	14 (19.2%)
3 - 4	3.6 (2)	37 (50.7%)
5 - 6	4.2 (1.8)	14 (19.2%)
> 6	2 (1.8 - 4)	8 (11 %)

Use of personal study aids

The anaesthetists' use of various personal study resources is described in Figure 4.2.

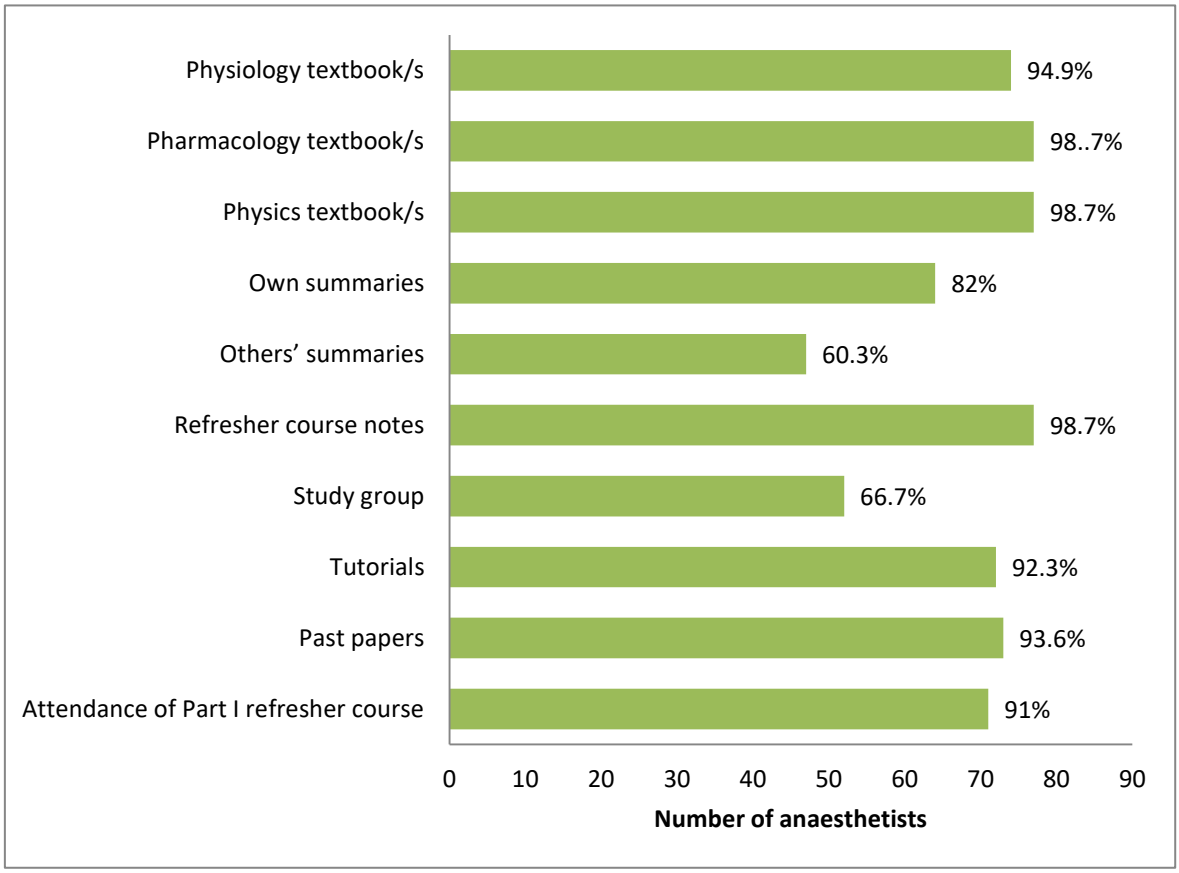


Figure 4.2. Anaesthetists' use of personal study resources

Departmental teaching modalities

The anaesthetists were asked about the usefulness of the various modes of teaching available at each site. Figures 4.4. and 4.5. demonstrate their response. The majority of anaesthetists rotated through CHBAH (n=38; 48.7%) and HJH/RMMCH (n=38; 48.7%) in the six months prior to writing the Part I examination.

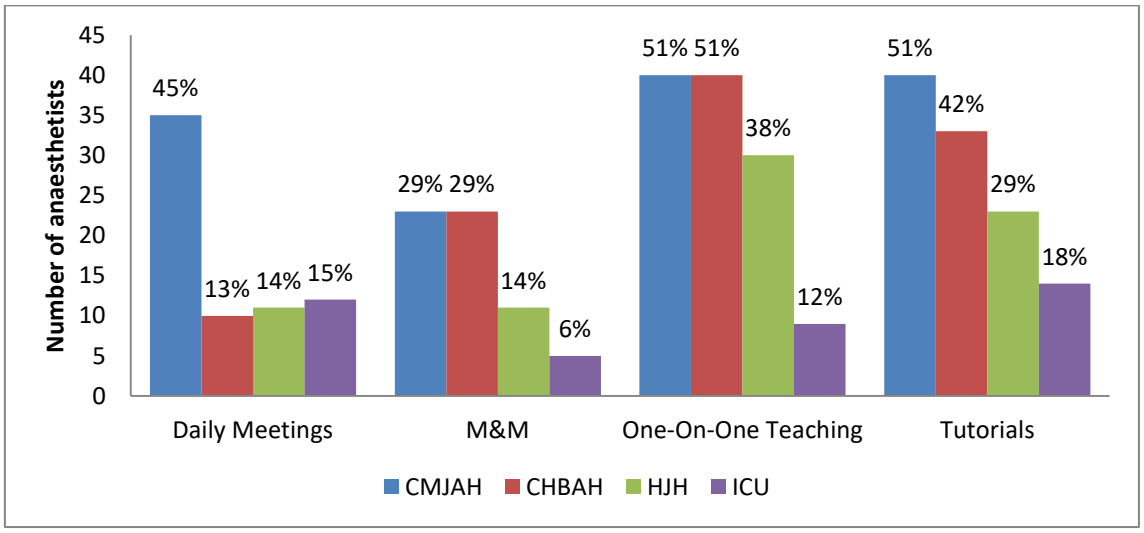


Figure 4.3. Number of anaesthetists who found the teaching to be useful

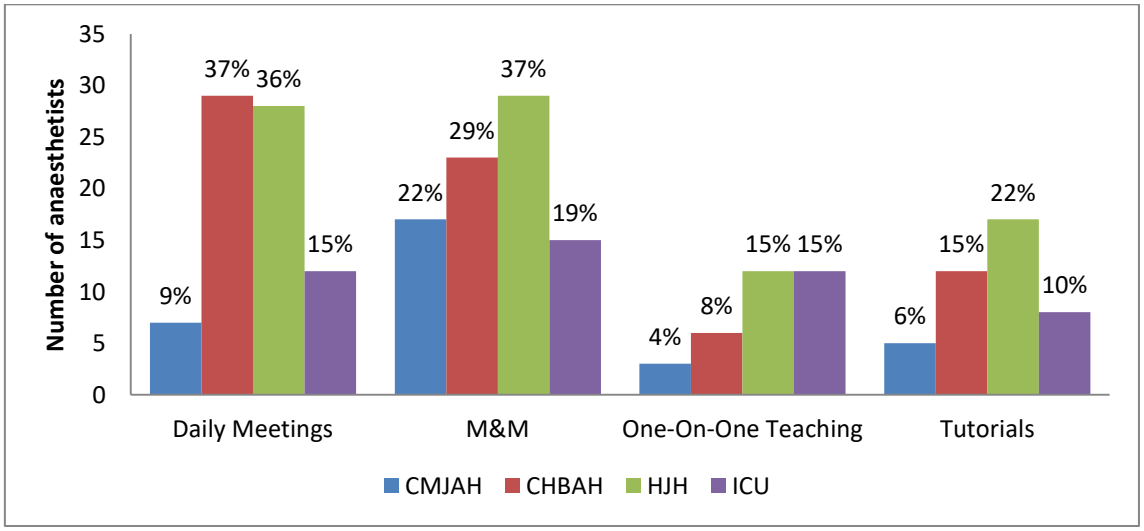


Figure 4.4. Number of anaesthetists who found the teaching to be not useful/inadequate

Primary objective 5: to describe the challenges faced by the anaesthetists with regard to their preparation for, as well as with the Part I examination itself

Table 4.9. is a summary of the preparation challenges faced by the anaesthetists.

Table 4.9. Preparation challenges faced by the anaesthetists

Preparation challenges	**Anaesthetists** n (%)
Factors affecting the cognitive load associated with studying	**58 (74.4%)**
Intrinsic load	
Quantity/volume; vast content	15 (19.2%)
Inability to prioritise topics and study material	8 (10.3)
Unsure about depth of knowledge required	5 (6.4%)
Not practical – mismatch between clinical and non-clinical aspects	2 (2.6%)
Extrinsic load	
Calls	16 (20.5%)
After hour tuts at the end of long work days or post call	8 (10.3%)
Information overload, too many resources spread out	4 (5.1%)
Time	**52 (66.7%)**
Not enough time to study and revise	37 (47.4%)
Time management	11 (14.1%)
Long days at work, difficulty concentrating	2 (2.6%)
Time wasted travelling to and from tutorials, traffic	2 (2.6%)

Table 4.9. cont. Preparation challenges faced by the anaesthetists

Preparation challenges	**Anaesthetists** n (%)
Work environment	**8 (10.3%)**
Balancing full-time work and study	3 (3.8%)
Departmental pressure	2 (2.6%)
Poor work environment	1 (1.3%)
Lack of motivation/support from senior staff	1 (1.3%)
Insufficient teaching – consultants not always helpful due to their inability to remember Part I knowledge	1 (1.3%)
Psychosocial issues	**53 (67.9%)**
Fatigue/exhaustion	17 (21.8%)
Balance between work, study and life responsibilities	13 (16.7%)
Stress/panic/anxiety	8 (10.3%)
Feeling inadequate and overwhelmed	4 (5.1%)
Lack of personal motivation	2 (2.6%)
Burnout	2 (2.6%)
Personal health issues	2 (2.6%)
Social isolation	2 (2.6%)
Sleep deprivation	1 (1.3%)
Financial stresses	1 (1.3%)
Lack of support system	1 (1.3%)

The anaesthetists described the various coping strategies they used to attempt to overcome their preparation challenges. These are summarised in Table 4.10.

Table 4.10. Coping strategies employed by the anaesthetists

Coping strategies	**Anaesthetists** n (%)
Minimal to no time spent on social activities	8 (10.3%)
Maximise study over weekends, pre- and post-call	7 (9%)
Study group	6 (7.7%)
Perseverance, basic coping skills	6 (7.7%)
Study early in the morning before work	4 (5.1%)
Study in theatre/at work/on call	4 (5.1%)
Support from colleagues, friends, family	4 (5.1%)
Use of study leave	4 (5.1 %)
Study timetable and time management	3 (3.9%)
Longer study hours, less sleep	3 (3.9%)
Use of annual leave to study	3 (3.9%)
Discussing with colleagues/consultants	3 (3.9%)
Stop comparing self to others	3 (3.9%)
Exercise	3 (3.9%)
Focus on goal, keep motivated	2 (2.6%)
Dedicated self-study	2 (2.6%)
Defer examination	2 (2.6%)
Get used to chronic fatigue, study while tired	2 (2.6%)
Coffee, energy drinks	2 (2.6%)
Good nutrition and healthy eating	2 (2.6%)
Seek advice from those who wrote recently	1 (1.3%)
Break down work into smaller chunks	1 (1.3%)
Study consistently	1 (1.3%)
Listening to podcasts while driving	1 (1.3%)
Limit attendance of after hour tuts	1 (1.3%)

In addition to the preparation challenges faced, the anaesthetists reported on the challenges they faced with the Part I examination itself. These are presented in Table 4.11.

Table 4.11. Examination challenges faced by the anaesthetists

Challenges	**Anaesthetists** n (%)
Intensity of examination - difficult to maintain focus	38 (48.7%)
Sleepless nights due to stress; anxiety	9 (11.5%)
Time constraint, time management	6 (7.7%
Too much content to cover, need a more relevant, structured syllabus	5 (6.4%)
Poor examination technique	4 (5.1%)
Failure to recall prior knowledge "going blank"	4 (5.1%)
Topics covered in a number of refreshers but not in textbooks, but these are examined - refreshers are not peer reviewed and not always correct, but many questions based solely on refresher notes	4 (5.1%)
Not knowing what level of knowledge is expected and trying to focus on 3 different subjects at once	4 (5.1%)
Detail of knowledge required	3 (3.9%)
Studying has to be self-directed	1 (1.3%)
Physics biggest problem	1 (1.3%)
No transparency or memorandum	1 (1.3%)
"Nil"	7 (9%)

Relevance of the Part I examination to clinical practice

The anaesthetists were asked to comment on their perceived relevance of the Part I examination to clinical practice. Their responses are summarised in Table 4.12

Table 4.12. Anaesthetists perceived relevance of the Part I examination

Relevance	**JC** n (%)	**SR** n (%)	**JR** n (%)	**MO** n (%)	**Total** n (%)
All very/mostly relevant	8 (33.3%)	14 (56%)	11 (40.7%)	1 (50%)	**34 (43.6%)**
Relevant but physics detail is a problem	7 (29.2%)	8 (32%)	5 (18.5%)	1 (50%)	**21 (26.9%)**
Detail required for examination vs. core knowledge - mismatch	4 (16.7%)	3 (12%)	1 (3.7%)	-	**8 (10.3%)**
Not relevant to clinical practice	4 (16.7%)	-	3 (11%)	-	**7 (9%)**
Changes practice for better	-	1 (4%)	2 (7.4%)	-	**3 (3.8%)**
Does not change practice much	-	5 (20%)	1 (3.7%)	-	**6 (7.7%)**

4.3.3. Secondary objectives

Secondary objective 1: to compare the learning styles of the anaesthetists according to the ASSIST based on their gender

Table 4.13. shows the comparison of learning styles of the anaesthetists based on gender. There was a statistical difference between the males and females as the females attained a higher score on the "strategic" learning style.

Table 4.13. Comparison of learning styles based on gender

Learning Style	Females mean/median (SD/IQR)	Males mean/median (SD/IQR)	p-value
Deep	14 (13.5-15)	14 (13.5-16)	0.75
Strategic	38 (29.5 - 31)	31 (27.5 - 37.5)	0.03
Surface	34 (7.5)	32.4 (7.7)	0.41

Secondary objective 2: to compare the learning styles and study strategies of the anaesthetists according to the ASSIST based on their number of attempts at the Part I examination

Table 4.14. shows the comparison of the learning styles study strategies of the anaesthetists based on their number of attempts at the Part I examination.

Table 4.14. Comparison of learning styles based on number of attempts to success

Learning Styles & Study strategies	**1st attempt mean/median** (SD/IQR)	**>1 attempt mean/median** (SD/IQR)	**p-value**
Deep	14 (13.5 - 16)	14 (13.5-15)	0.43
Relating ideas	11 (10 - 12)	10 (10 - 11.5)	0.48
Seeking meaning	4 (3.5 - 4)	4 (2.5 - 4)	0.41
Strategic	35 (29 - 40.5)	33 (26-37)	0.39
Organised studying	10.5 (2.6)	9.2 (3.1)	0.048
Monitoring effectiveness	4 (3 - 4)	4 (2 - 4)	0.43
Time management	10.3 (3.4)	9 (3)	0.05
Achieving	10 (9 - 12)	10 (8 - 12)	0.43
Surface	33.2 (7)	33.8 (8.7)	0.55
Unrelated memorising	8.3 (1.8)	8.9 (2.5)	0.8
Syllabus-boundness	5.5 (2.2)	5.2 (2.1)	0.2
Lack of purpose	5.4 (2.5)	5.6 (2.6)	0.5
Fear of failure	14 (3.1)	14.1 (4.1)	0.5

Secondary objective 3: to describe the study behaviours of those anaesthetists who were successful on their first attempt at the Part I examination.

There were 55 (70.5%) anaesthetists who had passed on their first attempt at the Part I examination. The median number of months into registrarship at which they attempted Part I was 13 (IQR 8-15). On average they had prepared for 8 (IQR 6-10) months prior to the examination.

Fifty four (98.2%) anaesthetists reported making use of an "intensive study period" closer to the examination.

Table 4.15. describes the anaesthetists' time management during the intensive study period. One anaesthetist did not elucidate further on the details of his/her use of intensive study period and another did not utilise an intensive study period. Most (n=29; 54.7%) of the anaesthetists typically studied intensively for 3-4 hours per day for an average of 3.4 (SD 1.8) months.

Table 4.15. Time management during intensive study period

Time spent studying (hours per day)	**Months** mean/median (SD/IQR)	**Anaesthetists** n (%)
1 - 2	3.7 (2.16)	10 (18.9%)
3 - 4	3.4 (1.8)	29 (54.7%)
5 - 6	4.1 (1.35)	7 (13.2%)
> 6	2 (1.5-3)	7 (13.2%)

Figure 4.5. describes the use of personal study resources amongst the anaesthetists. The green bars show the resources used by 54 out of 55 (98%) anaesthetists who were successful on their first attempt.

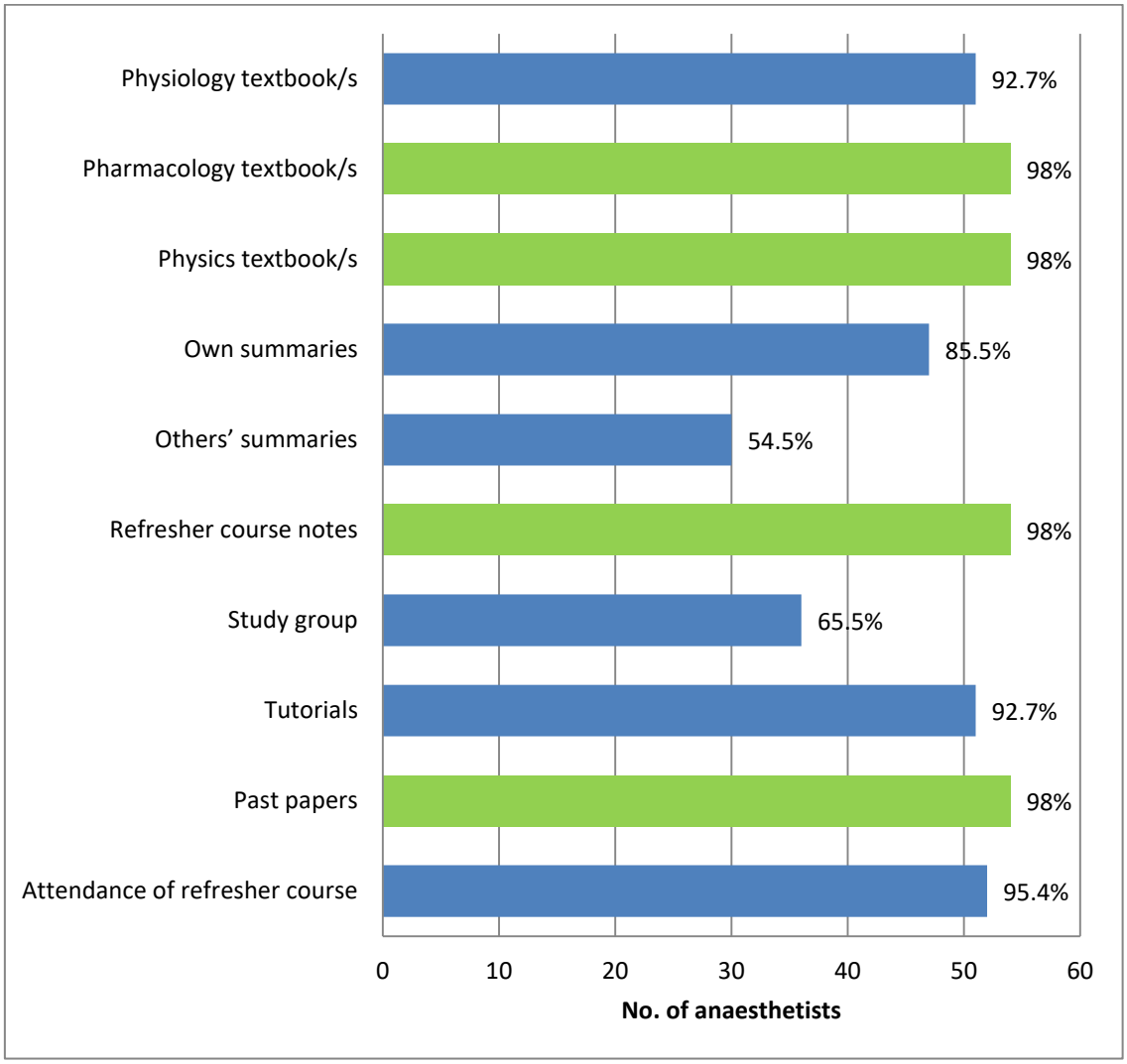


Figure 4.5. Use of personal study resources

Secondary objective 4: to describe the suggestions made by the anaesthetists on how the Department of Anaesthesiology may improve its support of teaching and learning for the Part I examination.

Table 4.16 is a summary of the suggestions put forth by the anaesthetists on how the departmental teaching programme may be improved.

Table 4.16. Suggestions for the improvement of the Part I teaching programme

Suggestion	**Anaesthetists** n (%)
Protected/dedicated teaching time "Weekly tuts with 2 - 3 on one day" "Consultants must relieve the registrars to attend tutorials"	27 (34.6%)
Tutorials "Tutorials and teaching during the day" "Tutorials before work" "6 months focused teaching and tutorial programme prior to examination" "Improve tutorial content and preparation by consultants and registrars" "More tutorials by consultants in theatre" "Link the content with what is applicable in theatre" "Tutorial programme" "Better selection of topics. Better reg preparations and better consultant/presenter preparation"	17 (21.8%)

Table 4.16. cont. Suggestions for the improvement of the Part I teaching programme

Suggestion	**Anaesthetists** n (%)
Assistance with examination technique "Review past papers with candidates" "Tuts to focus on practice answering examination questions" "Mock exams to improve examination technique" "Quarterly prep exams/tests prior to exams"	13 (16.7%)
Adult teaching programme with flexibility within the teaching programme "Adult teaching programme" "E-learning/online tutorial program to eliminate travelling (wasted time) and allow accessibility from home or from different hospitals" "Don't force people to attend tuts" "Learning styles differ, some feel the tuts are not helpful but for others it's essential. It wastes time if it's not helpful." "Flexibility. No fixed recipe for each person. People learn in different ways" "Part I is learning facts. If people want tuts, let them go. Others prefer self-study and ask if they don't understand"	7 (9%)

Table 4.16. cont. Suggestions for the improvement of the Part I teaching programme

Suggestion	**Anaesthetists** n (%)
Guidance with regard to best study resources "Compile a list of useful resources - a lot of time wasted to find the most helpful resource" "Compile all relevant resources into one book"	4 (5.1%)
Other Improve quality of teaching at morning and academic meetings Emphasis and support for studying	2 (2.6%)
Mentors "Mentors to track mentees study pattern and advise accordingly" "Mentors to guide mentees with regard to best resources for different subjects"	1 (1.3%)

4.4. Discussion

The findings of this study are in keeping with a larger body of educational literature that has identified various factors which may influence an individual's tendency to adopt different learning styles and study behaviours. These factors which may be considered as the interplay between the learner, the curriculum and mode of summative assessment, and the educational environment, jointly contribute to the final educational outcome of the student, thus supporting the need for "constructive alignment" within an educational system (4, 5, 8). Constructive alignment states that "in an educational system where these components are not necessarily integrated and tuned to support learning, only "academic" students spontaneously use higher-order learning processes, whereas

in an integrated system all aspects of teaching and assessment are attuned to support higher learning" (3, 4, 8). In postgraduate and continuing medical education, the students are adult learners who are qualified doctors (31). As such, the educational requirement of these adult learners is more the facilitation of their own learning rather than didactic teaching (43), where the desired learning outcome presumably is improving performance in practice and the health of patients overall (31). Improvement in the quality of the learning process requires insight into how doctors learn, and what motivates them to change their practice (31). This discussion will consider the impact of various aspects of the educational system on the learning styles and study behaviours adopted by the anaesthetists, in particular the anaesthetists' own roles in their learning, as well as the implications of the prevailing educational programme and assessment methods and the educational milieu where learning is expected to take place.

In this study sample, 70 (90%) anaesthetists were ultimately successful in the Part I examination, with 55 (70.5%) anaesthetists being successful on their first attempt. There was no statistical difference in the learning styles of those who passed on first attempt in comparison to those who attempted the examination more than once. Rather, the results of this study showed that all anaesthetists tended to adopt deep, strategic and surface learning styles to varying degrees, as evidenced by the average scores of 70% for "deep learning", 67.8% for "strategic learning" and 60.6% for "surface learning". Although females scored significantly higher on strategic learning compared to males (76% vs. 62% $p=0.03$), in view of the equivocal findings of other studies which compared learning styles based on gender (49, 97, 118), this difference may be an incidental finding of little relevance as the first attempt pass rate was similar for both groups (72% for females and 67% for males).

This study has shown that there were several determinants of the approaches to learning adopted by the anaesthetists in their preparation for the Part I

examination. Although there are identifiable factors which would support deep learning amongst the anaesthetists (which is a characteristic of successful adult learning and is the desired outcome (1), this study has also identified factors which may discourage deep learning, and induce surface and strategic approaches to learning instead.

Freedman (94) states that "the adult learner is someone who is motivated enough to want to pin further education at the end of a working day or is required to come to a program for certification". Therefore, the anaesthetists' voluntary participation in a postgraduate specialisation programme may reflect their intrinsic motivation towards deep learning, as evidenced by the higher average score of 68.6% obtained by the anaesthetists for the intention/interest and motivation-related sub-scales in comparison to their average score of 55% for the "lack of purpose" sub-scale. This positive relationship between motivation and the deep approach to learning is in keeping with findings of two other studies (49, 72) which showed first year Bachelor of Science and Economics students' tendency to adopt the surface approach to learning due to the subjects not being their "major" and therefore presumed to be peripheral to their interests. This is further supported by 96% of anaesthetists' perception of learning as "necessary to developing as a specialist" and "understanding new material for oneself". These findings highlight the impact of intrinsic motivation on the individual's approaches to and quality of learning.

However, despite deep learning having the highest score of 70%, the comparable scores of 67.8% for strategic learning and 60.5% for surface learning raise the question that perhaps the tendency toward deep learning in this circumstance may also have been a function of strategic learning, rather than a stand-alone learning style with its associated implications. The mode of assessment in the Part I examination being essay-type and short answer questions for this study population, may have stimulated the deep approach to learning as 9% of

anaesthetists had the perception that a "detailed" level of knowledge was required to pass the examination, but remained uncertain about what the required level of detail was. This confirms the findings of Scouller (34) and Tang (123), who showed that the assignment essay was perceived as assessing higher levels of intellectual skills and cognitive processing, whereas MCQ-based examinations were perceived as assessing knowledge based on lower levels of cognitive processing.

The anaesthetists' average scores of 66.7% for the "achieving" sub-scale and 70% for the "fear of failure" sub-scale support this and reveal a tendency towards adopting those learning approaches which will primarily enable them to pass the examination, rather than engage in self-directed learning processes which characterise deep learning. This is supported by 93.6% of anaesthetists' perception of learning as "building up knowledge by acquiring facts and information" and fewer anaesthetists thought learning meant "remembering things well long term" (87%) and "seeing things in a different and more meaningful way"(80.7%). Although one study conducted by Smith et al (72) showed that the mode of assessment (MCQ vs. essay questions) had no impact on the approaches to learning, the findings of this study are consistent with Scouller (34) and Thomas and Bain (124) who found that students were significantly more likely to employ surface learning approaches when preparing for their MCQ examination and deep learning approaches when preparing their assignment essays (34) and that overall students were strategic and may be versatile in their learning approaches depending on the learning situation (123).

From an andragogical perspective, the anaesthetists being "adult learners" theoretically ought to tend towards deep learning, as the positive association between maturity and the tendency towards a deep approach to learning has been demonstrated in studies conducted by Richardson (112), Harper & Kember (117) and Senemoğlu (97). Furthermore, deep learning is a product of self-directed learning where the student seeks meaning and relates ideas (109) and as

Mezirow (95) pointed out, "no concept is more central to what adult education is all about than self-directed learning". However, despite all anaesthetists in this study being in an adult educational programme, a striking finding of this study in comparison to other similar studies is the difference in the anaesthetists' attitudes toward self-directed learning. Only 9% of anaesthetists in this study advocated self-directed learning, in contrast to general practice registrars where 78.6% felt that learning should be a self-directed activity (57) and 67% family medicine registrars who chose self-study as their primary method of learning (54).

Furthermore, "adult learning" in our study was described by the anaesthetists as "more accessibility and flexibility within the current programme", and not necessarily as "self-directed learning" as is traditionally described in the education literature as "a process in which individuals take the initiative without the help of others in diagnosing their learning needs, formulating goals, identifying human and material resources, and evaluating learning outcomes" (96). On the contrary, one anaesthetist cited the need for self-directed learning as a challenge in preparation for the examination.

Moreover, 43.6% of anaesthetists requested more didactic modes of teaching in the form of one-on-one teaching and tutorials (21.8%), displaying greater alertness to assessment demands in the form of mock examinations and practice with answering past papers (16.7%), as well as seeking further guidance with regard to the "best study resources" from mentors and CA (CMSA) (5.1%). These are the characteristics of surface and strategic learning styles (18, 52), and suggest that the mind-set of the anaesthetists may not be adequately geared towards an adult educational programme.

In seeking an explanation as to why this may be the case, this study confirms the findings of other studies (2, 3, 27, 39, 99, 104, 108, 128) which have shown that the cognitive load associated with studying, time, exertion (effort) and discipline required, as well as psychosocial factors are some of the challenges which may

have affected their performance in an adult educational programme. Factors which increased both the intrinsic and extraneous cognitive load associated with studying were cited by 74.4% of anaesthetists as substantial challenges in their preparation for the Part I examination.

The factors which increased the intrinsic cognitive load associated with the task of studying were identified by anaesthetists as: the vast quantity/volume of content to be covered (19.2%), inability of some to prioritise topics and study material (10.3%), and uncertainty about the depth of knowledge required, together with the sometimes doubtful relevance of the subject matter to clinical practice (6.4%). These findings consistent with "cognitive load theory" (99) are in keeping with the observation made by the GMC in the earliest paper entitled "Tomorrow's Doctors" (37, 93) that the problem associated with a curriculum that is overloaded with detail, is that it imposes "a scarcely tolerable burden of information on the students, which taxes the memory but not the intellect".

The findings of this study confirm this as 15.4% of anaesthetists reported failure to recall information and 11.5% reported "going blank" in the examination and 3.9% attributed this to the detailed level of knowledge required, thereby supporting the suggestion made by 6.4% of the anaesthetists for the need for a more relevant, structured syllabus as there was "too much content to cover". This alludes to a degree of malalignment in this educational system because in an "aligned" system, the desired outcomes with regard to topic content as well as the required depth of understanding is specified, and the mode of assessment is appropriate in measuring the students' actual learning outcomes (4).

Burnstein et al (38) raised similar concerns in their study about the consequences of a vast, unweighted syllabus where the required depth of knowledge is undefined, and they evaluated the perceived relevance of the basic sciences syllabus in anaesthesiology amongst anaesthesiologists. The findings showed that approximately 65% of the basic science syllabus was perceived as essential to the

understanding and practice of everyday anaesthesia. In the present study, although 70.5% of the anaesthetists felt that the Part I syllabus was relevant to the practice of anaesthesiology, 26.9% of anaesthetists questioned the relevance of the detailed knowledge required for one subject (physics), and a further 10.3% felt that overall there is a mismatch between level of detail that is required for the examination when compared to the core knowledge required for the clinical practice of anaesthesiology. Interestingly, 87.5% of anaesthetists who held the latter opinion were junior consultants and senior registrars.

In contrast, findings of the study conducted by De Oliveira Filho et al (59) showed that the consultants' rating of the relevance of basic sciences knowledge was significantly higher than that of the residents ($p < 0.01$) and the residents were in favour of a more superficial approach, which was represented by learning of broader concepts, when compared to the consultants. This may suggest that the perceived relevance of basic sciences knowledge increased with seniority and experience. However, this was not found in the present study as 16.7% of the junior consultants felt that the Part I examination is not relevant to clinical practice when compared to 11% in the registrar groups. Of the senior registrars 20% (vs. 3.7% of junior registrars) felt that it does not change practice much, while more junior registrars (7.4%) felt that it changes practice for the better (in comparison to 4% of senior registrars and 0% of junior consultants).

It is known that "the perceived relevance of the subject matter is an essential condition for adult learning" (59) and a source of intrinsic motivation which may influence the quality of and approaches to learning adopted by the student, and perhaps, the educational outcomes (3, 62). In addition to intrinsic motivation, extrinsic motivation in the form of assessment has been described as the most potent factor influencing student learning behaviour (23) and the phrase "assessment drives learning" is universally acknowledged in that the assessment process does not only strongly impact the knowledge and skills acquired by

students (23), but also influences the student's approach to learning (33, 66, 120-122). It is has already been shown that if the volume to be learned is too great, the surface approach and rote learning may be reinforced even in students who prefer a deep approach (66). Therefore, the findings of this study, along with those of Burnstein et al (38) and the GMC's "Tomorrow's Doctors" (37, 93) highlight the need for the identification of an agreed-upon core syllabus, as the current syllabus may be overloaded with detail with little or no clinical relevance, thereby adding to the intrinsic cognitive load associated with the anaesthetists' learning.

In addition to factors contributing to the intrinsic cognitive load, the anaesthetists described factors which may add to the extraneous load of learning. Of the anaesthetists, 20.5% cited "calls" (compulsory after-hours work), 10.3% cited tutorials held after hours at the end of long work days or post call and 5.1% mentioned "information overload due to too many resources", and the need for further collation and verification of those resources which are "too spread out", as extraneous factors contributing to the cognitive load of studying. The intrinsic and extraneous cognitive load associated with the task of studying are additive and thereby impact the germane load (effort required) to effect learning (72, 99).

In addition to the aforementioned cognitive load, 66.7% of anaesthetists described time-related challenges, while 52.7% described demands of the work environment as factors which may impact their study behaviours. Lack of sufficient time to study (47.5%), ineffective time management (14.1%), time wasted spent in traffic travelling to and from tuts, as well as time constraints imposed by long days at work (5%) were some of the time-related challenges faced by the anaesthetists in their preparation for the Part I examination. This finding is consistent with Smith et al (72) who showed that there may be a decrease in tendency towards deep learning if there was substantial pressure to complete a complex task in a limited amount of time with pressure and time constraints, and this may therefore result in surface and strategic approaches to learning amongst the students. The

suggestion of protected teaching time during work hours was put forth by 34.6% of anaesthetists as well as the suggestion by two anaesthetists of an E-learning/online tutorial program to eliminate travelling (wasted time) and allow accessibility from home or from different hospitals.

The challenges relating to the work and educational environment described by 52.7% of the anaesthetists included maintaining a balance between work and study (24.4%) and feeling chronically fatigued (21.8%). Departmental pressure, poor work environment, lack of motivation/support from senior staff and insufficient teaching by consultants "due to their inability to recall Part I knowledge" were some of the other challenges cited by 6.4% of anaesthetists. This point of consultants not being able to give impromptu tutorials on a basic sciences topic was highlighted in the study by Burnstein et al (38) and raised the argument that if a topic was considered integral to the clinical practice of anaesthesiology, it should be possible to impart that knowledge to others.

Furthermore, in keeping with the notion that "adults are most interested in learning subjects that have immediate relevance and impact to their job" (91, 92), 21.8% of anaesthetists identified positively with those teaching modalities which aid in contextualising Part I knowledge by linking their application to daily clinical practice. Tutorials and "one-on-one" teaching by consultants in theatre have been identified as two such teaching modalities, and were found to be consistently useful at all training sites. These findings are in keeping with the findings of the study (57) conducted amongst general practice registrars, which showed that more than 90% of registrars found tutorials (95.2%) and discussion of problems with their trainer (90.5%) to be helpful to their learning. In a learning environment when the relevance of information to be learned may not be obvious, discussion with individuals with a different range of knowledge or higher level of understanding will increase the amount of practical knowledge and understanding of the subject matter (100). The findings of this study, together with others (57, 59,

100) which highlight the role of instructors in the teaching of basic sciences, and suggests that these teaching modalities are beneficial and may foster deep and meaningful learning, and should be optimised at all teaching sites.

Apart from the aforementioned challenges, 67.9% of anaesthetists described a myriad of psycho-social factors which posed significant challenges during their experience with the Part I examination. These included difficulties with maintaining a balance between work, study and life responsibilities, mental and emotional fatigue, stress/panic/anxiety, poor examination writing technique, feeling inadequate and overwhelmed, lack of personal motivation, burnout, personal health issues, social isolation, sleep deprivation, financial stresses, and the lack of a support system. These are factors which have previously been identified and consolidated in a focused literature review by Mitchell et al (27) as factors that have been extensively discussed in the literature as those which may affect the residents' professional – and as an extension – academic performance. These psycho-social factors illuminate the non-academic challenges faced by adult learners. As a result, it may be more difficult for adults to easily adapt to programme requirements and it therefore becomes crucial to prioritise tasks. If the challenges outweigh the ability of the learner to cope and overcome said challenges, the learning outcome will be compromised (27) . Taking that into consideration, programme curators need to allow for flexibility within the programme, taking into account busy, inflexible schedules and adult responsibilities and appreciate the possibility that personal obligations might obstruct the learning process.

The nature of these challenges reported by the anaesthetists emphasise the need for "exertion" and "discipline" in the form of organised studying and effective time management. The findings of this study support this. Although there was no significant difference in the learning styles of those who passed on first attempt compared to those who did not, a statistically significant difference was found in

the sub-scale of "organised studying" where the first attempt group scored higher (70% vs. 61.3% p=0.048). Notably, only 50% of the anaesthetists who returned the questionnaire had given an organised account of their approaches to studying using a study plan consisting of three points or more, while 11.5% did not answer the question at all. This highlights an area regarding the anaesthetists' own awareness of their study behaviour that requires more attention. Within the described study plans, 51.3% of anaesthetists elucidated on their use of various study resources and 25.6% mentioned time-related strategies.

In terms of the overall use of various study resources, the findings of this study are in general in keeping with findings of studies (54, 57) conducted amongst other registrars who are in postgraduate programmes, however some notable differences exist. In this study, over 90% of anaesthetists found tutorials, formal lectures in the form of refresher courses, textbooks and past papers useful, while personal summaries (82%), study groups (66.7%) and others' summaries (60.3%) were lesser used resources. In a similar study (57) conducted amongst general practice registrars, the findings showed that 71% of registrars reported that they found formal lectures useful, while others found tutorials (95.2%), study groups (88.1%) and problem-solving sessions (88.1%) to be more helpful. These findings are congruent with the findings of the study (54) which was conducted amongst family medicine residents which showed that although all residents used a variety of educational activities, the three most common resources used for self-study were textbooks (26%), medical journals (20%), and point-of-care resources (12%).

This wide variation in learning preferences and study behaviours highlights what one anaesthetist stated: "there is no fixed recipe for each person. People learn in different ways." However, despite this variation in the study behaviour of the anaesthetists, the findings of this study have revealed common study strategies regarding time management and the use of various study resources amongst those anaesthetists who were successful on their first attempt. The anaesthetists

who were successful on their first attempt had prepared for an average of eight months prior to the examination, of which 98.2% reported making use of an "intensive study period" during which most (54.7%) typically studied intensively for 3-4 hours per day for an average of 3.4 months.

The most common resources used by 98% of these anaesthetists were pharmacology and physics textbooks, refresher course notes, and practice with past examination papers. The second most common resources used by 92.7% of anaesthetists were physiology textbooks, attendance of tutorials and attendance of an annual Part I refresher course. Less commonly used strategies included the use of anaesthetists' own summaries (85.5%), participation in a study group (65.5%) and use of others' summaries (54.5%). Similarly, other studies (40) which investigated factors that improved surgical residents ABSITE performance, found that amount of study and conference attendance were positively correlated with ABSITE performance.

In conclusion, the findings of this study show that a student's educational outcome is determined by the interaction of academic and non-academic challenges and the student's ability to overcome them, be it in the form of adapting one's learning styles or study strategies, employing more effective coping mechanisms, or greater support from structures within the educational environment. This is vital because, although the individual numbers reflected in this study sample may appear to be small, it should be acknowledged that in this particular group with an ultimate pass rate of 91% and first time pass rate of 70.5% in the Part I examination, the majority have been successful in overcoming their individual challenges. In contrast, a large group exists which is not represented within this study population – the "other 50%" who are on average, not successful in a particular sitting of the Part I examination, who may be facing similar or greater challenges, and may have not yet managed to overcome them. Therefore, the findings of this study raise awareness that the dynamics which

influence individuals' learning styles and study behaviours should be concern not only to the students, but also to their training institutions and the overarching body responsible for curriculum and assessment design. Ultimately, it is the combined effort of each of these components that lays the foundation for the development and execution of a successful adult learning programme.

4.5. Summary

The results of this study have been presented in this chapter and discussed as per the research objectives. The data presented include demographic data of the study population and responses to a self-administered regarding the learning styles and study behaviours of anaesthetists at Wits. The findings have been described and analysed using descriptive and inferential statistics.

In the final chapter a summary, the limitations, recommendations and conclusions of the study are presented.

Chapter 5 | Summary, limitations, recommendations & conclusion of the study

5.1. Introduction

In this chapter, a summary of the aim and objectives, research methodology and results of the study will be presented. The limitations of the study and recommendations for future practice and research will also be discussed, followed lastly by the conclusion of the study.

5.2. Summary of the aim and objectives of the study

The aim of this study was to describe the learning styles and study behaviours of anaesthetists in the postgraduate programme at Wits, particularly in the context of their preparation strategies for the Part I examinations. The aim of this study was achieved by means of the following objectives.

Primary objectives:

- to describe the perceptions of learning amongst the anaesthetists
- to describe the learning styles amongst the anaesthetists using the ASSIST questionnaire
- to describe the use of learning and study strategies amongst the anaesthetists using the ASSIST questionnaire
- to describe the study behaviours of the anaesthetists in preparation for the Part I examination
- to describe the challenges faced by the anaesthetists with regard to their preparation for, as well as with the Part I examination itself.

Secondary objectives:

- to compare the learning styles of the anaesthetists according to the ASSIST based on their gender

- to compare the learning styles of the anaesthetists according to the ASSIST based on their number of attempts at the Part I examination
- to describe the study behaviours of those anaesthetists who were successful on their first attempt at the Part I examination.
- to describe the suggestions made by the anaesthetists on how the Department of Anaesthesiology may improve its support of teaching and learning for the Part I examination.

5.3. Summary of the research methodology

A prospective, cross-sectional, contextual, descriptive study was conducted amongst the anaesthetists on the Wits circuit who had attempted the Part I examination from 2010 to 2015. A purposive sampling method was used, and all anaesthetists who were invited to participate in the study were provided with a self-administered questionnaire which was developed by the researcher based on the validated ASSIST questionnaire, in consultation with an expert in the fields of Anaesthesiology and Education. The anaesthetists were allowed to take the questionnaires home and complete them at their convenience until the end of the data collection period.

Ethics and other relevant approvals were obtained prior to conducting the study. In order to maintain anonymity, no identifying data were collected, and confidentiality was preserved as questionnaires were returned by the participants directly into a sealed, marked box which was opened once the data collection period had ended. Data were collected from December 2015 to July 2016. Descriptive and inferential statistics were used to report the results of the study. Measures were put in place to ensure the validity and reliability of the study.

5.4. Summary of the results

Seventy eight completed questionnaires were returned, and this constituted a 72.9% response rate. In this study sample, 70 (90%) anaesthetists were ultimately

successful in the Part I examination, with 55 (70.5%) anaesthetists being successful on their first attempt. The anaesthetists scored highest (70%) for "deep learning" with a similar score of 67.8% for "strategic learning", while the "surface learning" style attracted the lowest score of 60.6%. The tendency towards deep learning was supported by the anaesthetists' perceptions of learning, with 88% of the anaesthetists agreeing with statements which support deep learning. Females scored significantly higher than males for "strategic learning" (76% vs. 62% p=0.03) although the first time pass rate was similar for both groups (72% for females and 67% for males). There were no significant differences in the learning styles between the groups of anaesthetists based on their number of attempts at the Part I examination, although the study may have been underpowered in this regard. However, there was a statistically significant difference in the strategy/behavioural sub-scale of "organised studying" where the first attempt group scored higher (70% vs. 61.3% p=0.048). Further, the anaesthetists described the challenges they faced in their preparation for and writing of the Part I examination, together with the coping strategies they employed in an attempt to overcome their challenges. Lastly, the anaesthetists provided suggestions on how the Department of Anaesthesiology at Wits may improve its programme and support for teaching and learning.

5.5. Limitations

The following were limitations of this study.

- It was beyond the scope of this study to invite all candidates who had attempted the Part I examinations from the years 2010 to 2015. This may lead to a selection bias towards those who have been successful in the Part I examination and had subsequently continued in the programme, as opposed to those who were unsuccessful and may not have been admitted to (or may have left) the Wits programme.

- This study is contextual in nature: it has described the learning styles and study behaviours only of the anaesthetists who were still present on the Wits circuit at the time of data collection. Therefore, these findings may not apply to the broader, or a different population.
- Anaesthetists who were unsuccessful on first or subsequent attempts may have chosen not to participate, as evidenced by a lower response rate in the group who did not pass on first attempt (60.5%) in comparison to those who were successful on first attempt (79.7%).
- Lastly, it needs to be acknowledged that the candidates' performance in an examination is not a consequence of their learning styles and study behaviours alone. There are many other factors within and outside of the learning system that may influence the way an individual performs on the day.

5.6. Recommendations

5.6.1. Recommendations for practice

There are recommendations arising from this study which pertain to potential Part I candidates, as well as to those responsible for curating the postgraduate teaching programmes and those in charge of the curriculum design and assessment procedures.

Potential Part I candidates:

Figure 5.1. illustrates the recommended approach for Part I candidates who are preparing for the examination.

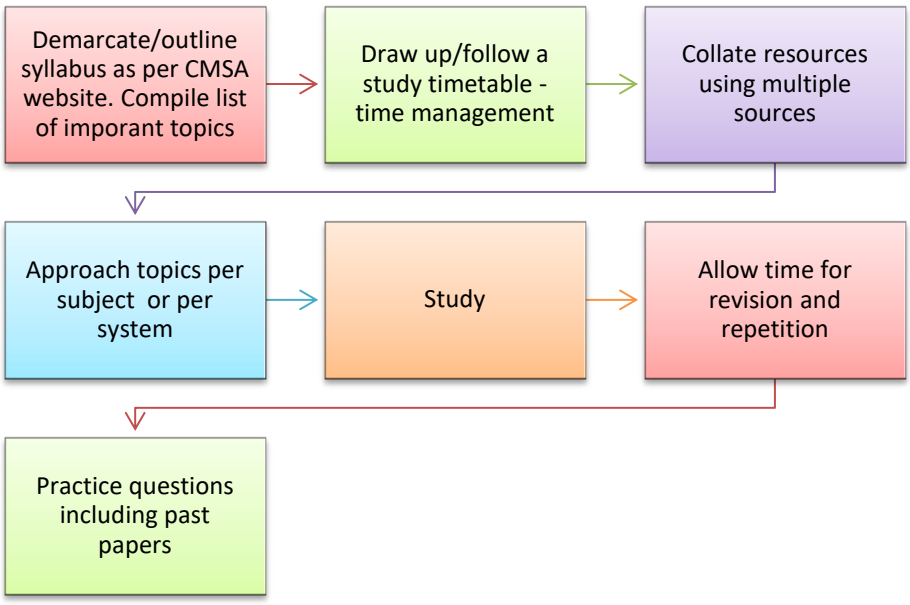


Figure 5.1. Recommendations for potential Part I candidates

Teaching programme curators:

- Diverse teaching and learning behaviours should be taken into account by those responsible for curating the teaching programme. e.g. anaesthetic consultants should receive training on how to teach, and further, should engage more with Part I teaching in theatre – even if it means mastery of only one or two topics in each subject. Subject matter is easier to learn and remember long-term if it is contextualised into daily practice.
- Consideration should be given to providing protected teaching time for candidates for a protracted period prior to the examination. However, this also requires commitment from the candidate to write at the agreed sitting, and can be offered once only if necessary so as to meet the demands of clinical service delivery.

- In view of the difficulties experienced by the anaesthetists in attending the teaching programme at the various sites, the creation of an E-learning/online tutorial programme using a video conferencing programme would be a practical solution to eliminate time wasted travelling, as well as providing accessibility from home or from different hospitals.
- Quarterly internal tests/mock examinations as a method of ongoing assessment and preparation for the Part I examination, as well as providing exercise of examination-taking skills.
- Greater involvement of mentors for academic and emotional support, as well as earlier identification and support for those at risk of ineffective study behaviours.

Curriculum and assessment designers:

- Detailed review of the Part I syllabus, defining the depth of knowledge required per topic, especially in physics.
- Consider publishing guidelines in keeping with "blueprints" provided by other disciplines within the CMSA, as well as weighting of "core" and "non-core" knowledge, as is appropriate to the clinical practise of anaesthesiology.
- Peer-review of refresher course notes and lectures to validate as reliable resources for the Part I examinations.

5.6.2. Recommendations for further research

- Institute some of the recommended changes in the teaching programme and assess the impact on productivity and satisfaction amongst the anaesthetists.
- Once these changes are instituted, this study should be repeated nationally especially in view of the format change of the Part I examination.

5.7. Conclusion

The anaesthetists at Wits were diverse in their approaches to learning and the factors which may have influenced their learning styles and study behaviours speak to both their intrinsic and extrinsic motivation for learning. The findings of this study further suggest that the anaesthetists may not necessarily be attuned to the requirements of adult learning, when compared (internationally) to registrars in other disciplines. A possible explanation for this may be found in some of the academic and non-academic challenges cited by the anaesthetists in their experience with the Part I examination viz. the immense cognitive load associated with studying, time constraints, a demanding work environment, chronic fatigue and other psychosocial factors. In attempting to overcome these challenges, the anaesthetists had to adapt their study behaviours and develop effective coping mechanisms in order to be successful in the examination.

This realisation, that a student's educational outcome is the result of the interplay between academic and non-academic challenges and the student's ability to overcome them, is vital. The findings of this study raise awareness that the dynamics which influence individuals' learning styles and study behaviours should be of concern not only to students, but also to their training institutions and the overarching body responsible for curriculum and assessment design, as each of these components contribute individually to the development and execution of a successful adult learning programme.

REFERENCES

1. College of Anaesthetists of South Africa. Curriculum for trainees in anaesthesiology 2014 https://www.cmsa.co.za/view_college.aspx?collegeid=12013 [2014/06/28].

2. Rogers IR, Leach D, Brookes JG. Why don't trainees pass the emergency medicine fellowship examination? Emergency Medicine. 2004;16(4):336-42.

3. Janssen PJ. Studaxology: the expertise students need to be effective in higher education. Higher Education. 1996;31(1):117-41.

4. Biggs J. Enhancing teaching through constructive alignment. Higher Education. 1996;32(3):347-64.

5. Biggs J. What the student does: teaching for enhanced learning. Higher Education Research & Development. 1999;18(1):57-75.

6. Barrows HS, Tamblyn RM. Problem-based learning: an approach to medical education. New York: Springer; 1980.

7. Schmidt HG. Problem-based learning: rationale and description. Medical Education. 1983;17(1):11-6.

8. Hutchinson L. Educational environment. BMJ 2003;326 810.

9. De Oliveira Filho GR, Schonhorst L. Problem-based learning implementation in an intensive course of anaesthesiology: a preliminary report on residents' cognitive performance and perceptions of the educational environment. Medical Teacher. 2005;27(4):382-4.

10. Colleges of Medicine of South Africa. FCA (SA) Part I. Results of FCA (SA) Part I over the last five years ed2014.

11. Au O. Study habits for hybrid learning. In: Cheung SKS, Fong J, Kwok L-F, Li K, Kwan R, editors. Hybrid Learning. Lecture Notes in Computer Science. 7411: Springer Berlin Heidelberg; 2012. p. 265-73.

12. Biggs J. Individual differences in study processes and the Quality of Learning Outcomes. Higher Education. 1979;8(4):381-94.

13. Cassidy S. Learning styles: An overview of theories, models, and measures. Educational Psychology. 2004;24(4):419-44.

14. Credé M, Kuncel NR. Study habits, skills, and attitudes: The third pillar supporting collegiate academic performance. Perspectives on Psychological Science. 2008;3(6):425-53.

15. Curry L. Cognitive and learning styles in medical education. Academic Medicine. 1999;74(4):409-13.

16. de Lima AA, Bettati MI, Baratta S, Falconi M, Sokn F, Galli A, et al. Learning strategies used by cardiology residents: Assessment of learning styles and their correlations. Education for Health: Change in Learning & Practice 2006;19(3):289-97.

17. de Saintonge D, Chaput M, Dunn DM. Gender and achievement in clinical medical students: a path analysis. Medical Education. 2001;35(11):1024-33.

18. Entwistle NJ, Hanley M, Hounsell D. Identifying distinctive approaches to studying. Higher Education. 1979;8(4):365-80.

19. Hawk TF, Shah AJ. Using learning style instruments to enhance student learning. Decision Sciences Journal of Innovative Education. 2007;5(1):1-19.

20. Bruner JS. The act of discovery. Harvard Educational Review. 1961;31:21-32.

21. de Jong T, Ferguson-Hessler MGM. Types and qualities of knowledge. Educational Psychologist. 1996;31(2):105-13.

22. Dobson JL. A comparison between learning style preferences and sex, status, and course performance. Advances in Physiology Education. 2010;34(4):197-204.

23. Elton LRB, Laurillard DM. Trends in research on student learning. Studies in Higher Education. 1979;4(1):87-102.

24. Derossis AM, Da Rosa D, Schwartz A, Hauge LS, Bordage G. Study habits of surgery residents and performance on American Board of Surgery in-training examinations. The American Journal of Surgery. 2004;188(3):230-6.

25. Godellas CV, Huang R. Factors affecting performance on the American Board of Surgery in-training examination. The American Journal of Surgery. 2001;181(4):294-6.

26. McClintock JC, Gravlee GP. Predicting success on the certification examinations of the American Board of Anesthesiology. Anesthesiology. 2010;112:212-9.

27. Mitchell M, Srinivasan M, West DC, Franks P, Keenan C, Henderson M, et al. Factors affecting resident performance: Development of a theoretical model and a focused literature review. Academic Medicine. 2005;80:376-89.

28. Nagle PC. Predicting the success of an anesthesiology trainee: Is there a method to our madness? Anesthesiology. 2010;112:212-9.

29. Newble DI, Hejka EJ, Whelan G. The approaches to learning of specialist physicians. Medical Education. 1990;24(2):101-9.

30. Pask G. Styles and strategies of learning. British Journal of Educational Psychology. 1976;46(2):128-48.

31. Smits PBA, Verbeek JHAM, Nauta MCE, ten Cate OTJ, Metz JCM, Van Dijk FJH. Factors predictive of successful learning in postgraduate medical education. Medical Education. 2004;38(7):758-66.

32. Tait H, Entwistle NJ. Identifying students at risk through ineffective study strategies. Higher Education. 1996;31(1):97-116.

33. Newble DI, Jaeger K. The effect of assessments and examinations on the learning of medical students. Medical Education. 1983;17(3):165-71.

34. Scouller K. The influence of assessment method on students' learning approaches: Multiple choice question examination versus assignment essay. Higher Education. 1998;35(4):453-72.

35. Marton F, Säljö R. On qualitative differences in learning I - Outcome and process. British Journal of Educational Psychology. 1976;46(1):4-11.

36. van Merriënboer JJG, Sweller J. Cognitive load theory and complex learning: Recent developments and future directions. Educational Psychology Review. 2005;17(2):147-77.

37. The General Medical Council. Tomorrow's Doctors. London 1993.

38. Burnstein RM, Jeevaratnam RD, Jones JG. The need for basic sciences in the understanding and practice of anaesthesia. Anaesthesia. 1997;52(10):935-44.

39. McManus IC, Keeling A, Paice E. Stress, burnout and doctors' attitudes to work are determined by personality and learning style: A twelve year longitudinal study of UK medical graduates. BMC Medicine. 2004;2:29-12.

40. Godellas CV, Hauge LS, Huang R. Factors affecting improvement on the American Board of Surgery in-training exam (ABSITE). Journal of Surgical Research. 2000;91(1):1-4.

41. Bull DA, Stringham JC, Karwande SV, Neumayer LA. Effect of a resident self-study and presentation program on performance on the thoracic surgery in-training examination. The American Journal of Surgery. 2001;181(2):142-4.

42. Dewey J. How We Think. Buffalo, NY: Prometheus Books; 1991.

43. Slotnick HB. How doctors learn: Education and Learning across the medical-school-to-practice trajectory. Academic Medicine. 2001;76(10):1013-26.

44. The Colleges of Medicine of South Africa. Regulations for the admission to the Fellowship of the College of Anaesthetists of South Africa FCA(SA). Johannesburg2013.

45. Richardson D, Oswald A, Chan M-K, Lang E, Harvey B. CanMEDS 2015 Physcian Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada.

46. De Oliveira Filho GR, Vieira JE. The relationship of learning environment, quality of life, and study strategies measures to anesthesiology resident academic performance. Anesthesia & Analgesia. 2007;104(6):1467-72

47. De Oliveira Filho GR, Sturm EJH, Sartorato AE. Compliance with common program requirements in Brazil: Its effects on resident's perceptions about quality of life and the educational environment. Academic Medicine. 2005;80:98-102.

48. Entwistle N, McCune V, Tait H. Approaches and Study Skills Inventory for Students (ASSIST) (incorporating the Revised Approaches to Studying Inventory - RASI) Report of the development and use of the inventories http://www.etl.tla.ed.ac.uk/docs/test.html [28/06/2014].

49. Brown S. Approaches and Study Skills Inventory for Students (ASSIST) in an Introductory Course in Chemistry. Journal of University Teaching & Learning Practice. 2015;12(3).

50. West A. Formative Evaluation of the Transition to Postgraduate Study for Counselling and Psychotherapy Training: Students Perceptions of Assignments and Academic Writing. Counselling and Psychotherapy Research: Linking Research with Practice,. 2012;12(2):128-35.

51. Heussi A. Postgraduate student perceptions of the transition into postgraduate study. Student engagement and Experience Journal. 2012;1(3).

52. Newble DI, Entwistle NJ. Learning styles and approaches: implications for medical education. Medical Education. 1986;20(3):162-75.

53. Cebeci S, Dane S, Kaya M, Yigitoglu R. Medical Students' Approaches to Learning and Study Skills. Procedia - Social and Behavioral Sciences. 2013;93:732-6.

54. Sy A, Wong E, Boisvert L. Learning behaviour and preferences of family medicine residents under a flexible academic curriculum. Canadian Family Physician. 2014;60(11):e554-e61.

55. van der Vyver M. Who are anaesthesiologists? http://www.cas.ca/English/who-are-anesthesiologists: Canadian Anaesthesiologists' Society; 2010 [08/12/2016].

56. Vohra A. The role of the anaesthetist: replacement brain. Anaesthesia. 2001;56(3):272.

57. Lesmes-Anel J, Robinson G, Moody S. Learning preferences and learning styles: a study of Wessex general practice registrars. British Journal of General Practice. 2001;51(468):559-64.

58. Newble DI, Clarke RM. The approaches to learning of students in a traditional and in an innovative problem-based medical school. Medical Education. 1986;20(4):267-73.

59. De Oliveira Filho GR, Schonhorst L. Attitudes of residents and anesthesiologists toward basic sciences. Anesthesia & Analgesia. 2006;103(10):137-43.

60. Entwistle NJ, McCune V. Approaches and study skills inventory for students (ASSIST) 2000 [01/07/2014]. Available from: http://www.tla.ed.ac.uk/etl/questionnaires/ASSIST.pdf.

61. Entwistle NJ, Tait H, McCune V. Patterns of response to an approaches to studying inventory across contrasting groups and contexts. European Journal of the Psychology of Education. 2000 (In press).

62. Marton F, Säljö R. On qualitative differences in learning II - Outcome as a function of the learner's conception of the task. British Journal of Educational Psychology. 1976;46(2):115-27.

63. Boyle EA, Duffy T, Dunleavy K. Learning styles and academic outcome: The validity and utility of Vermunt's Inventory of Learning Styles in a British higher education setting. British Journal of Educational Psychology. 2003;73(2):267-90.

64. Abedin NFZ, Jaafar Z, Husain S, Abdullah R. The Validity of ASSIST as a measurement of learning approach among MDAB Students. Procedia - Social and Behavioral Sciences. 2013;90:549-57.

65. Brown S, Wakeling L, Naiker M, White S. Approaches to study in undergraduate nursing students in regional Victoria, Australia. International journal of nursing education scholarship. 2014;11.

66. Fransson A. On qualitative differences in learning: IV - effects of intrinsic motivation and extrinsic test anxiety on process and outcome. British Journal of Educational Psychology. 1977;47(3):244-57.

67. Gijbels D, Van de Watering G, Dochy F, Van den Bossche P. The relationship between students' approaches to learning and the assessment of learning outcomes. European Journal of Psychology of Education. 2005;20(4):327.

68. Hasnor HN, Ahmad Z, Nordin N. The Relationship between Learning Approaches and Academic Achievement Among Intec Students, Uitm Shah Alam. Procedia - Social and Behavioral Sciences. 2013;90:178-86.

69. Liew SC, Sidhu J, Barua A. The relationship between learning preferences (styles and approaches) and learning outcomes among pre-clinical undergraduate medical students. BMC Medical Education. 2015;15:44.

70. Lynch TG, Woelfl NN, Steele DJ, Hanssen CS. Learning style influences student examination performance. The American Journal of Surgery. 1998;176(1):62-6.

71. Rehman R, Ahmed K, Rehan R, Hassan F, Syed F. Learning approaches and performance of medical students. JPMA The Journal of the Pakistan Medical Association. 2016;66(2):198-202.

72. Smith S, Miller R. Learning approaches: examination type, discipline of study, and gender. Educational Psychology. 2005;25(1):43-53.

73. D'Sa J. Nursing students' approaches to learning and studying: a cross-sectional study in an Indian setting. International Journal of Current Research and Review. 2013;5(3):47-53.

74. Health Professions Act 56 of 1974, (1974).

75. HPCSA. http://www.hpcsa.co.za/About http://www.hpcsa.co.za/About [22/11/2016].

76. Regulations for admission to the Fellowship of the College of Anaesthetists of South Africa FCA (SA), (2016).

77. CMSA mission and goals https://www.cmsa.co.za/Default.aspx [30/11/2016].

78. Norman G, Norcini J, Bordage G. Competency-Based Education: Milestones or Millstones? Journal of Graduate Medical Education. 2014;6(1):1-6.

79. Swing S. The ACGME outcome project: retrospective and prospective. Medical Teacher. 2007;28:648-54.

80. General Medical Council. Working with doctors Working for patients 2016 [cited 28/01/2017]. Available from: http://www.gmc-uk.org/education/postgraduate.asp.

81. The Scottish Doctor. Learning Outcomes for The Role of the Doctor within the Health Service [28/01/2017]. Available from: http://www.scottishdoctor.org.

82. New requirements for the registration of specialists in South Africa, (2010).

83. College of Obstetricians and Gynaecologists of South Africa. Blueprint for FCOG (SA) Part 1A & B

http://www.collegemedsa.ac.za2013 [30/04/2015].

84. College of Surgeons of South Africa. FCS (SA) Intermediate Examination Blueprint for Paper 1: Principles of Surgery in General http://www.collegemedsa.ac.za. [cited 30/04/2015].

85. College of Physicians of South Africa. Blueprint of the theory papers http://www.collegemedsa.ac.za [7/4/2015].

86. The FRCA Examination http://www.rcoa.ac.uk/examinations/overview [07/04/2015].

87. The Royal College of Anaesthetists. Exam publications https://www.rcoa.ac.uk/examinations/exams-publications [2017/03/10].

88. The Royal College of Anaesthetists. CCT in Anaesthetics, Annex B –Basic Level Training. Basic sciences to underpin anaesthetic practice2010. p. 76-93.

89. Bourne W. The role of basic sciences in anesthesia. Anesthesia & Analgesia. 1949;28(5):288-9.

90. The Royal College of Anaesthetists. Syllabus. Primary and Final Examinations for the FRCA. http://www.rcoa.ac.uk/examinations/exam-syllabus-and-regulations1996 [2017/03/10].

91. Conlan J, Grabowski S, Smith K. Emerging perspectives on learning, teaching, and technology. http://epltt.coe.uga.edu/index.php?title=Adult_Learning2003.

92. Knowles M. The Adult Learner: A Neglected Species. 3rd ed. Houston: Gulf Publishing; (1984).

93. Rubin P, Franchi-Christopher D. New edition of Tomorrow's Doctors. Medical Teacher. 2002;24(4):368-9.

94. Freedman J. Reflections of a Teacher of Adults. New Directions in Continuing Education. 1985;26:97-102.

95. Mezirow J. A Critical Theory of Self-Directed Learning. New Directions for Continuing Education. 1985;N25 17-30:17.

96. Knowles MS. "Self-Directed Learning", A Guide for Learners and Teachers. New York: Cambridge Books; 1975.

97. Senemoğlu N. College of Education Students' Approaches to Learning and Study Skills. Education and Science. 2011;36(160):65-79.

98. Glaser R. Intelligence as acquired proficiency. In: Stemberg RJ, Detterman DK, editors. What is intelligence? Contemporary viewpoints on its nature and definition. Norwood: Ablex publishing corporation; 1986.

99. Young JQ, Van Merrienboer J, Durning S, ten Cate OTJ. Cognitive Load Theory: Implications for medical education: AMEE Guide No. 86. Medical Teacher. 2014;36(5):371-84.

100. Taylor DCM, Hamdy H. Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. Medical Teacher. 2013;35(11):e1561-e72.

101. Sweller J. Cognitive load during problem-solving: Effects on learning. Cognitive Science. 1988;12:257-85.

102. Sweller J. Cognitive load theory, learning difficulty, and instructional design. Learning and Instruction. 1994;4(4):295-312.

103. Sweller J, van Merrienboer JJG, Paas FGWC. Cognitive architecture and instructional design. Educational Psychology Review. 1998;10(3):251-96.

104. Kirschner PA. Cognitive load theory: implications of cognitive load theory on the design of learning. Learning and Instruction. 2002;12(1):1-10.

105. Atkinson RC, Shiffrin RM. Human Memory: A Proposed System and its Control Processes. In: Spence KW, Spence JT, editors. Psychology of Learning and Motivation. Volume 2: Academic Press; 1968. p. 89-195.

106. Miller GA. The magical number seven, plus or minus two: some limits on our capacity for processing information. Psychology Review. 1956;63:81-97.

107. Kirschner PA, Sweller J, Clark RE. Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. Educational Psychologist. 2006;41(2):75-86.

108. van Merriënboer JJG, Sweller J. Cognitive load theory in health professional education: design principles and strategies. Medical Education. 2010;44(1):85-93.

109. Svensson L. Symposium: Learning processes and strategies III. British Journal of Educational Psychology. 1977;47(3):233-43.

110. Miller CML, Parlett M. Up to the mark: A study of the examination game. London: Society for Research in Higher Education, 1974.

111. Webster R, Cowan E, editors. Learning styles and design: The use of ASSIST for reflection and assessment. HERDSA; 2002.

112. Richardson JTE. Students' perceptions of academic quality and approaches to studying in distance education. . British Educational Research Journal. 2005;31:1-21.

113. Speth CA, Namuth DM, Lee DJ. Using the ASSIST Short Form for evaluating an information technology application: validity and reliability issues. Informing Science Journal. 2007;10:109-19.

114. Tait H, Entwistle NJ, McCune V. ASSIST: a reconceptualisation of the Approaches to Studying Inventory. Oxford: Oxford Brookes University, The Oxford Centre for Staff and Learning Development; 1998.

115. Teixeira C, Gomes D, Borges J. The Approaches to Studying of Portuguese Students of Introductory Accounting. Accounting Education. 2013;22(2):193-210.

116. Diseth Å. Validation of a Norwegian Version of the Approaches and Study Skills Inventory for Students (ASSIST): Application of structural equation modelling. Scandinavian Journal of Educational Research. 2001;45(4):381-94.

117. Harper G, Kember D. Approaches to Study of Distance Education Students. British Journal of Educational Technology. 1986;17(3):212-22.

118. Wickramasinghe DP, Samarasekera DN. Factors influencing the approaches to studying of preclinical and clinical students and postgraduate trainees. BMC Medical Education. 2011;11:22-.

119. Rochmawati E, Rahayu GR, Kumara A. Educational environment and approaches to learning of undergraduate nursing students in an Indonesian school of nursing. Nurse education in practice. 2014;14(6):729-33.

120. Ramsden P. Context and strategy: Situational influences on learning. Schmeck RR, editor. New York: Plenum Press; 1988.

121. Thomas PR, Bain JD. Consistency in learning strategies. Higher Education. 1982;11: 249–59.

122. Watkins D. Factors influencing the study methods of Australian tertiary students. Higher Education. 1982;11:369–80.

123. Tang KCC. Perceptions of task demand, strategy attributions and student learning. Research and Development in Higher Education 1992;14:474–81

124. Thomas PR, Bain JD. Contextual dependence of learning approaches: the effects of assessments. Human Learning. 1984;3:227-40.

125. de Virgilio CCT, Kaji A, Miller K. Weekly assigned reading and examinations during residency, ABSITE performance, and improved pass rates on the American Board of Surgery examinations. Journal of Surgical Education. 2008;65(6):499-503.

126. Hirvela E, Becker D. Impact of programmed reading on ABSITE performance. American Board of Surgery In-Training Examination. American Journal of Surgery. 1991;162:487-90.

127. de Virgilio C, Stabile B. Weekly reading assignments and examinations result in sustained improvement in American Board of Surgery In-Training Examination (ABSITE) scores. The American Surgeon. 2005;71:830-2.

128. Stecker T. Well-being in an academic environment. Medical Education. 2004;38(5):465-78.

129. World Medical Association. Declaration of Helsinki. Ethical principles for medical research involving human subjects. Seoul 2013.

130. Department of Health. Guidelines for good clinical practice in the conduct of clinical trials with human participants in South Africa. Pretoria, South Africa2006.

131. Brink HI. Fundamentals of research methodology for health care professionals: Juta & Co. Ltd.; 1996.

132. Burns N, Grove S. Understanding Nursing Research. 3rd ed. Philedelphia: Saunders Elsevier; 2003.

133. Draugalis J, Coons S, Plaza C. Best Practices for Survey Research Reports: A Synopsis for Authors and Reviewers. American Journal of Pharmaceutical Education. 2008;72(1).

134. Endacott R, Botti M. Clinical research 3: Sample selection. Accident and Emergency Nursing. 2007;15:234-8.

135. Botma Y, Greeff M, Mulaudzi M, Wright S. Research in Health Sciences. Cape Town: Pearson Education South Africa (Pty) Ltd; 2010.

APPENDICES

Appendix A – Approval of title

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Ms Thokozile Nhlapo
E-mail: thokozile.nhlapo@wits.ac.za

16 April 2015
Person No: 1032389
PAG

Dr S Mahomed
112 Brenthurst Court
39 3rd Street
Killarney
2193
South Africa

Dear Dr Mahomed

Master of Medicine: Approval of Title

We have pleasure in advising that your proposal entitled *The learning styles and study behaviours of anaesthetists in a postgraduate training programme* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix B – Ethics Committee approval

R14/49 Dr Sameerah Mahomed and Lionel Green-Thompson

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M140835

NAME: (Principal Investigator)	Dr Sameerah Mahomed and Lionel Green-Thompson
DEPARTMENT:	Anaesthesiology Charlotte Maxeke Johanesburg Academic Hospital
PROJECT TITLE:	The Learning Styles and Study Behaviours of Anaesthetists in a Postgraduate Training Programme
DATE CONSIDERED:	29/08/2014
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Juan Scribante
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	15/04/2015

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**.

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix C – Author's permission



Gmail - Request for permission to use ASSIST questionnaire https://mail.google.com/mail/u/0/?ui=2&ik=6bfc1064fc&view=pt&q...

Gmail

Sameerah Mahomed <dr.smahomed@gmail.com>

Request for permission to use ASSIST questionnaire

Noel Entwistle <nentwist@staffmail.ed.ac.uk> Wed, Jul 16, 2014 at 5:51 PM
To: Sameerah Mahomed <dr.smahomed@gmail.com>

You are welcome to use ASSIST in your study. It is free to use.

Hope the research goes well,

Noel Entwistle

Quoting Sameerah Mahomed <dr.smahomed@gmail.com> on Wed, 16 Jul 2014 14:15:10 +0200:

> Dear Sir and Madams
>
> Greetings from South Africa.
>
> My name is Sameerah Mahomed. I am currently doing my Masters degree in anaesthesiology at the University of Witwatersrand in Johannesburg, South Africa. My research is based on the learning styles and strategies used amongst the post graduate trainees in anaesthesiology in their preparation for the Part I exams.
>
> I request permission to use the ASSIST questionnaire as part of the questionnaire I am compiling. The expected sample size of my study is between 50 and 70.
>
> Your urgent advice in this regard, as well as whether there will be any cost involved, will be greatly appreciated.
>
> Many kind regards,
>
> –
> "Dr Sameerah Mahomed"
> MBChB (UKZN)

–
Noel Entwistle
Professor Emeritus, School of Education, University of Edinburgh
Mail address: Annandale, Ormiston Hall, Ormiston, EH35 5NJ
Telephone:01875-340729

–
The University of Edinburgh is a charitable body, registered in Scotland, with registration number SC005336.

Appendix D – Information letter

Information Letter

Dear colleagues, greetings and good wishes.

My name is Sameerah Mahomed and I am an anaesthetic registrar at Wits. I would like to invite you to participate in my MMed research study, "**The learning styles and study behaviours of anaesthetists in a postgraduate training programme.**"

This study has been approved by the Human Research Ethics Committee (HREC)(Medical) M140835 and Postgraduate Committee of the University of Witwatersrand.

The results of the anaesthesiology Part I examinations over the recent years have raised cause for concern. The aim of my study is to describe the learning styles and study behaviours of anaesthetists, particularly in the context of their preparation strategies for the Part I exams. Attached is a questionnaire, which consists of four sections.

- The first section is based on demographic data and prior academic experience.
- The second section has questions regarding your own experience of the Part I examination, and the subsequent outcome.
- The third section is based on the ASSIST which is an inventory to describe the skills and strategies used in the approach to studying.
- The last section has a few questions on your perceptions of learning.

Your participation in this study is voluntary. You are free to withdraw at any time, without having to provide a reason. There is no possible penalty or repercussion if you do not participate. If you do wish to participate at a later stage during the data collection period, you are most welcome to do so.

Your participation in this study is completely anonymous. Your questionnaire will not identify you in any way nor will any identifying information be collected. If you feel that any of the questions will identify you, feel free to omit said questions. Results published will have no identifying data, and will be made available to participants of this study.

There is no time limit on completing the questionnaire. Once you have completed your questionnaire, place it in the unmarked envelope and seal it. Place the envelope in the sealed box provided. There will be a sealed box provided at each site. The content of the questionnaire will be viewed only by my research supervisors and myself. **Please return your questionnaire, even if it hasn't been answered completely.**

By returning your questionnaire, your consent to participate in this study is implied. Please ensure you have read and understood all of the above information before completing the questionnaire.

If you are interested in finding out your results on the ASSIST, please let me know. If you would like an in-depth analysis of your study strategies, there is a more detailed questionnaire (LASSI) which I can make available to you. Let me know by leaving your email address on the sheet you will sign when you hand in the questionnaire. If you feel concerned or overwhelmed by your difficulties with studying, please visit the Department of Anaesthesiology Wellness Committee for appropriate referral.

Thank you for taking the time to read this letter. If you have any queries or concerns regarding this study, you may contact the following people:

- Professor Cleaton-Jones (chairperson of the HREC): +27 11 717 1234
- Sameerah Mahomed (researcher): +27 83 356 8462 or dr.smahomed@gmail.com

Yours sincerely,

Sameerah Mahomed

Appendix E - Questionnaire

QUESTIONNAIRE

Section A

Tell us about yourself

1. Gender: ☐ Male ☐ Female
2. Age: _____
3. Ethnicity: ☐ Asian ☐ Black ☐ Coloured ☐ Indian ☐ White ☐ Other:_____
4. Home language: ☐ English ☐ Other:_____

Academic background

General

1. High school: Public ☐ Private ☐ Ex-Model C ☐ Rural ☐

2. Which year did you graduate with your medical degree? _____

3. Which university did you graduate from?

☐ University of Cape Town
☐ University of Free State
☐ University of Kwa-Zulu Natal
☐ University of Limpopo
☐ University of Pretoria
☐ University of Stellenbosch
☐ University of the Witwatersrand
☐ Other: _____

4. Do you have any other degrees or qualifications outside of medicine? If yes, please specify.
   ☐ Yes ☐ No

_____

Anaesthetic background

5. What is your current rank in the Dept. of Anaesthesiology?

☐ Medical Officer post-DA
☐ Junior registrar pre-Part I
☐ Senior registrar post-Part I
☐ Junior consultant post-Part II

6. How many years of experience do you have in providing anaesthesia care? _____

To registrars:

How far are you in your postgraduate training in terms of months? _____

Have you completed your senior rotations?

☐ Yes
☐ No
☐ In the process

Section B:

Tell us about your experience with the Part I exam

1. Which Part I exam(s) did you attempt?
☐ FCA
☐ MMed (Anaes)

2. After how many months in your registrar training did you first attempt the Part I exam?
(If medical officer, state pre-registrar training) _____

3. Have you been successful in the Part I exam? ☐ Yes ☐ No

4. If yes, after how many attempts were you successful?
☐ 1
☐ 2
☐ 2, of which 1 attempt was a rewrite of a single subject.
Which subject? ☐ Physics ☐ Pharmacology ☐ Physiology
☐ ≥ 3 attempts

5. **Please indicate the timing of your attempt(s) in the table below:**

Attempt	FCA I or MMed	Mar/Aug/Dec (M / A / D)	Within the same or following year of first attempt?	Successful Y or N
1				
2				
3				
4				

6. Regarding **your preparation for the Part I examination:**
   a. Did you devise a study plan? ☐ Yes ☐ No
   b. If yes, what was the broad outline of your study plan?(e.g. subject by subject or topic by topic, integrating the subjects as applicable)
   _____
   _____
   _____
   c. How many months or weeks prior to the exam did you begin to prepare for the Part I?
   _____
   d. Was there an intensive or focused study period prior to the exam? ☐ Yes ☐ No
   e. If yes, how long did this period last for? _____
   f. How many hours a day did you **typically** spend studying during this period?
   ☐ 1-2 ☐ 3-4 ☐ 5-6 ☐ >6
   g. Were you consistent in your studying? ☐ Yes ☐ I found it difficult to be consistent because _____
   _____

7. Personal Study Aids

Using a scale of 0 to 5, please rate the usefulness of the following in your preparation for the exam: (0 = did not use; 1 = not useful at all; 5 = I doubt I would have passed without it)

Prescribed textbooks (specify which)	0	1	2	3	4	5
Physiology_____						
Pharmacology_____						
Physics_____						
Summarising topics and reviewing them before the exam	0	1	2	3	4	5
Summaries made by others	0	1	2	3	4	5
Notes from previous refresher courses	0	1	2	3	4	5
Part of a study group	0	1	2	3	4	5
Practice on past exam papers	0	1	2	3	4	5
Attendance of tutorials	0	1	2	3	4	5
Attendance of Part I refresher courses	0	1	2	3	4	5
Other (please specify:						

8. Departmental Study Aids

a. Which hospital(s) were you rotating at during the six months prior to the exam?

☐ CMJAH ☐ CHBAH ☐ HJH/RMMCH ☐ Klerksdorp ☐ ICU _____

b. Which of the following departmental study aids did you find helpful in your preparation for the Part I exam? (Y = helpful; N = not helpful, N/A = non-existent)

Form of Teaching	CMJAH	CHBAH	HJH/RMMCH
Daily academic meetings			
Departmental morbidity and mortality meetings			
One-on-one teaching by consultants in theatre			

c. Do you have any suggestions on how the department may improve its teaching programme?

_____
_____
_____
_____
_____
_____
_____
_____

3

8. What are some of the challenges you faced in your **preparation** for the Part I exam?

9. How did you attempt to overcome them?

10. What are some of the chief problems you faced with the **Part I examinations itself**?

11. In your opinion, how much of the subject matter covered in the Part I syllabus do you apply in your daily practice in anaesthesiology? Please elaborate.

Section C: Approaches and Study Skills Inventory

The next part of this questionnaire asks you to indicate your relative agreement or disagreement with comments about studying made by other students. Please work through the comments giving your immediate response. In deciding your answers, think in terms of the Part I exam. It is also very important that you answer all the questions: check you have.

5 means agree (√) 4 = agree somewhat (√?) 2 = disagree somewhat (×?) 1 = disagree (×)
Try not to use 3 = unsure (??) unless you really have to.

1.	I managed to find conditions for studying which allowed me to get on with my work easily.	5	4	3	2	1
2.	Often I found myself wondering whether the work I was doing was really worthwhile.	5	4	3	2	1
3.	I organised my study time carefully to make the best use of it.	5	4	3	2	1
4.	I found I had to concentrate on memorising a good deal of what I had to learn.	5	4	3	2	1
5.	Often I felt I'm drowning in the sheer amount of material we had to cope with.	5	4	3	2	1
6.	I tried to relate ideas I came across to those in other topics or sections whenever possible.	5	4	3	2	1
7.	I think I'm quite organised and systematic when it comes to revising for exams.	5	4	3	2	1
8.	I'm pretty good at getting down to work whenever I need to.	5	4	3	2	1
9.	Much of what I was studying made little sense; it's like unrelated bits and pieces.	5	4	3	2	1
10.	I thought about what I wanted to get out of the exam, to keep my studying well-focused.	5	4	3	2	1
11.	When I worked on a new topic, I tried to see in my own mind how all the ideas fit together.	5	4	3	2	1
12.	I often worried whether I'll ever be able to cope with the work properly.	5	4	3	2	1
13.	I feel that I'm getting on well, and this helps me put more effort into the work.	5	4	3	2	1
14.	I concentrated on learning just those bits of information I thought I have to know to pass.	5	4	3	2	1
15.	When I look back, I sometimes wonder why I decided to ever come here.	5	4	3	2	1
16.	I work steadily rather than leave it all to the last minute.	5	4	3	2	1
17.	Ideas in prescribed books or articles often set me off on long chains of thought of my own.	5	4	3	2	1
18.	Before starting work on an exam question, I think first how best to tackle it.	5	4	3	2	1
19.	I often seemed to panic if I got behind with my work.	5	4	3	2	1
20.	I put a lot of effort into studying because I was determined to do well.	5	4	3	2	1
21.	I geared my studying closely to just what seems to be required for the exams.	5	4	3	2	1
22.	I usually planned out my week's work in advance, either on paper or in my head.	5	4	3	2	1
23.	I often had trouble in making sense of the things I have to remember.	5	4	3	2	1
24.	Often I lie awake worrying about work I think I won't be able to do.	5	4	3	2	1
25.	I don't find it at all difficult to motivate myself.	5	4	3	2	1

Section D: Perceptions of learning

When you think about 'learning' what does it mean to you? Consider each of the following statements carefully, and rate them in terms of how close they are to your own way of thinking about it.

	Very close	Quite close	Not so close	Rather different	Very different
a. Making sure you remember things well long-term	5	4	3	2	1
b. Developing as a specialist	5	4	3	2	1
c. Building up knowledge by acquiring facts and information	5	4	3	2	1
d. Understanding new material for yourself	5	4	3	2	1
e. Seeing things in a different and more meaningful way	5	4	3	2	1

Thank you very much for completing this questionnaire. It is much appreciated!

If you would like an in-depth assessment of your study strategies, the LASSI questionnaire is available, email me: dr.smahomed@gmail.com

6