THE PRAXIS AND RESEARCH OF HUMAN ANATOMY THROUGH AUTOETHNOGRAPHY

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DECLARATION 1: PLAGIARISM

I, **Lelika Lazarus**, declare that:

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Lelika Lazarus

SUPERVISORS :

…… **……..**

PROF KS SATYAPAL **PROF R SOOKRAJH**

DECLARATION 2: PUBLICATIONS

The publications (*in press* and submitted) that constitute this thesis and the contribution I made to each of the manuscripts are presented here.

Manuscript 1

Lazarus L, Sookrajh R, Satyapal KS (2016) Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating From a Selected South African University. *Ethnography*, Manuscript number: ETH-16-0097. (Under Review).

My supervisors and I designed the study and I conducted all literature searches and wrote the paper. The supervisors provided valuable input through reviewing all manuscript drafts and providing critical comments.

Manuscript 2

Lazarus L, Sookrajh R, Satyapal KS (2016) Communities of practice: a new methodology in anatomical research and teaching. *Anatomical Sciences Education*, Manuscript number: ASE-16-0159. Under Review.

Authors contributions:

I designed, conducted all the fieldwork, processed and analysed the data and wrote the manuscript. The supervisors guided the design, provided logistical support during fieldwork, reviewed all the drafts of the manuscripts and provided critical comments.

Manuscript 3

Lazarus L, Sookrajh R, Satyapal KS (2016) Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education. *African Journal of Health Professions Education*, Manuscript number: 871. Under Review

Author contributions

I designed, conducted all the fieldwork, processed and analysed the data and wrote the manuscript. The supervisors guided the design, provided logistical support during fieldwork, reviewed all the drafts of the manuscripts and provided critical comments.

Manuscript 4

Lazarus L, Sookrajh R, Satyapal KS (2016) Reflective Journals: Unmasking student perceptions of anatomical education. *Folia Morphologica*, Manuscript number: #48600. *In Press*

I designed, conducted all the fieldwork, processed and analysed the data and wrote the manuscript. The supervisors guided the design, provided logistical support during fieldwork, reviewed all the drafts of the manuscripts and provided critical comments.

Manuscript 5

Lazarus L, Sookrajh R, Satyapal KS (2016) 'Anytime, Anywhere'- Tablet technology in medical education. *British Medical Journal-Open*, Manuscript number: bmjopen-2016-013871. Under Review

Author contributions

I designed, conducted all the fieldwork, processed and analysed the data and wrote the manuscript. The supervisors guided the design, provided logistical support during fieldwork, reviewed all the drafts of the manuscripts and provided critical comments.

Signed: …… **Date**: …20/12/2016……

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…… **……..**

PROF KS SATYAPAL **PROF R SOOKRAJH**

DEDICATION

This story is about faith, for it is only in faith that you can truly find yourself. And it is about family, for without them you know nothing about being accepted just as you are. Accept what you cannot change and believe in truths you cannot see.

I dedicate this work to my family

My Mum and late Dad (Mrs and the late Mr S.S. Ramsaroop) and my sisters (Nerissa, Verushka and Evashna). You have always supported the endeavors that fulfill me and my passions. You have loved, guided, and befriended me every step of the way. I am who I am today because of you!

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- A special note of thanks to my co-authors, who took time of out of their busy schedules to participate in this project. All of your thoughts and insights were helpful in the construction of this research project and has resulted in the formulation of a manuscript that is currently under review. I have learned a lot from all of you.
- Thank you to all the medical students at the University of KwaZulu Natal who have participated in this research project and has also resulted in a manuscript under review. I am extremely grateful that you all indulged me.
- Anatomy educators from the various national medical schools in South Africa. Thank you for your participation and input, the results of which are also under consideration for publication.
- Thank you to all the staff at the Department of Anatomy, University of KwaZulu Natal for your constant encouragement and support.
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ABSTRACT

This thesis is in manuscript format, as per the guidelines of the College of Health Sciences of the University of KwaZulu Natal. It comprises five manuscripts that have been submitted to accredited journals for publication (one manuscript is currently *in press* and the others are awaiting final status after revisions were completed).

The use of autoethnography as an approach is an emerging transformative field of study within the Health Sciences at Higher Education institutions and is a move away from the key traditional positivist models of research in the domain of anatomical education.

This study with praxis and research at the nucleus, aimed to investigate the following: (i) challenges experienced in the teaching and learning of human anatomy; (ii) the views and perceptions of fellow colleagues regarding research in the domain of clinically applied anatomy and how this has impacted on their teaching practices; (iii) the opinions of senior anatomy instructors regarding the state of anatomical knowledge at their respective institutions; (iv) student attitudes and experiences regarding human cadaveric dissection through an analysis of their journal-reflective writings; and (v) the use of mobile devices by learners at a selected medical school.

Each of these aims stated above were achieved through the articles which comprised the manuscript of this study.

In the first manuscript, *Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating from a Selected South African University* I describe the methodological approach of autoethnography, specifically as it applies to reflection and memory work, and describe how this style enabled me to interrogate the current challenges and dilemmas underpinning the research, teaching and learning practices within this discipline. This was done through the use of an exclusive autoethnographic approach which is a qualitative method of research that seeks to describe and examine personal experience to comprehend cultural practice. The autoethnographic study highlighted challenges experienced, and these included the shortage of cadaveric material for teaching and research, the subsequent implementation of medical software applications, deficiencies in the curriculum and the teaching of anatomy by scientist anatomists.

The second manuscript was entitled *Communities of Practice: a new methodology in anatomical research and teaching*. In this the notion of collaborative autoethnography as a research method is introduced. In this approach, researchers worked in tandem with me to gather autobiographical material to analyse and understand their data collectively with each contributing to an understanding of the sociocultural phenomena.

This type of research allowed for in-depth learning about the self and others and fostered collaboration among researchers in this field of applied anatomy. The use of semi-structured interviews with co-authors (n=10) on co-written papers formed the essential method used in generating this article. The collaborative autoethnographic study revealed four important themes namely: the value of research collaboration; the impact of human anatomical variations; the association with medical and non-medical collaborators; and teaching practice emanating from collaborative research.

In manuscript 3, *Views of South African Academic Instructors regarding the Scholarship of Teaching and Learning in Anatomy Education,* a reflective design is presented and it is understood that reflecting on teaching is commonly referred to as an essential practice for personal and professional development. Open-ended questionnaires were distributed to senior anatomy faculty based at the eight national medical schools in South Africa. The emerging argument in this paper is that educational research into the scholarship of teaching and learning anatomy includes engaging in discipline-specific literature on teaching, reflecting on individual pedagogical methods and communicating these findings to peers. In medical education, reflection has been considered to be a core skill in professional ability. Faculty teaching anatomy highlighted several challenges such as time constraints within the medical curriculum, the lack of cadavers to reinforce knowledge and lack of appropriately qualified staff in the delivery of the subject.

The anatomy laboratory is an ideal setting for faculty/student interaction and provides important occasions to investigate active learning and reflection on anatomical knowledge. This forms the basis of the Manuscript 4, *Reflective Journals: Unmasking student perceptions of anatomical education,* in which seventy-five journals from medical and allied Health Science students were collected and analysed. Through the use of journal-reflective writing as a technique, student attitudes and experiences of human cadaveric dissection of anatomy were analysed. Student reflective journals highlighted the following themes which included (a) Dissecting room stressors, (b) Educational value of dissection , (c) Appreciation, Gratitude, Respect & Curiosity for the cadaver , (d) Positive and negative sentiments expressed in the dissecting room , (e) Benefit of alternate teaching modalities, (f) Spirituality/Religious Beliefs, (g) Shared humanity and emotional bonds, (h) Acknowledgement of human anatomical variations, (i) Beauty and complexity of the human body, and (j) Psychological detachment .

For the final manuscript which forms this compilation, *Anytime, Anywhere': Tablet technology in Medical education,* a questionnaire comprising both open and closed- ended questions was analysed from 179 (60 male; 119 female) second year medical students registered for the Anatomy course to establish the use of mobile devices by learners at a selected medical school. The themes that emerged from m-learning included students' ideas on mobile device engagement, and propositions related to the advantages and challenges affecting use of mobile devices.

The use of autoethnography as a research approach can be considered dissident, and an ‘anatomical turn’ in the praxis and research in the domain of anatomical education. This study highlights relevant contributions to the research, praxis (teaching and learning) of human anatomy through views of all significant role players – students, researchers and educators. The conceptual framework which was abstracted from the articles and the thesis in its entirety, offers significant understandings regarding the praxis and research of human anatomy within the context of educational theory.

CHAPTER 1

Introduction, Materials & Methods

1.1 The Spirit of Anatomy: Mapping the Anatomical Terrain

"People of the ancient world had a very poor knowledge of the human body. They resorted to home-made remedies and they had no idea of how the body's organs function. There was a popular belief that the spleen was the source of laughter, the gallbladder that of hate, the liver that of love, and that intelligence originated in the heart and haughtiness in the lungs"

Bosman et al. (2006; p. xi)

In outlining the anatomical landscape, the above quotation by Bosman et al. (2006) touches a personal chord in my experiences as a teacher and researcher at an Institution of Higher Learning in South Africa. As a child, I was enthralled with the workings of the human body and believed that the heart was the only organ that controlled all emotion. However, my understanding and perceptions changed as I learnt more and the transition to a more scientific knowledge base was borne. I stumbled across the works of Giroux (2003), Apple (2004), and Pascale (2011) whose commentaries on knowledge production provided me with the necessary insight into a conceptual understanding of teaching and learning and a realisation of the competing forces that impact on knowledge creation. This was a defining period in my life and from this understanding emerged a deeper insight of human anatomy.

I came to understand anatomy as the science of the structure of the body. 'Anatomy' is derived from the Greek word '*anatome*' which is a term constructed from 'ana,' meaning 'up' and 'tome,' meaning 'a cutting up' (O' Rahillay et al., 2004). Martini and Bartholomew (2007) state that, anatomy involves a study of inner and outer structures and physical relationships between body parts. In this thesis, anatomy refers to the gross anatomy of the human body. Adequate anatomical knowledge is essential for surgeons and for anyone who performs an invasive procedure on a patient (Papa and Vaccarezza, 2013). Jones (1997; p34) defines an 'anatomist' as "a dissector of dead bodies, a person skilled in anatomy." Turney (2007) states that anatomy is an essential foundation of knowledge for all medical careers.

This thesis is an exploration of my journey as a university anatomy educator situated within a rapidly evolving profession. The aim of this study was to examine the praxis and research of human anatomy pedagogy through qualitative methodological processes of autoethnography. Praxis, as captured in the title of this thesis, refers to a specific philosophy used to direct and perform research (Provenzo and Provenzo, 2008). It denotes a method by which a theory, lesson, or skill is endorsed, represented, or understood. 'Praxis' may also be defined as the act of engaging, relating, exercising and comprehending ideas (Provenzo and Provenzo, 2008).According to Tierney and Sallee (2008), those who engage in praxis-oriented explorations involve the community or group under investigation in the research process. Praxis-based research is a lengthy process that involves establishing mutually advantageous associations between the researcher and members of the community under investigation. By engaging

in collaborative research, researchers may assist members to acquire the critical tools to change their own lives (Tierney and Sallee, 2008).

In this study I use autoethnography within the ambit of a qualitative-research domain and I have drawn on the ontological position that the world is experienced and, therefore, can be described and anticipated. Munro (2011) states further that this ontological paradigm can be defined by an epistemological strategy of interpretation rather than facts and definitive conclusions which allows the researcher to be embedded in the research process. Having come from a strong positivist background, the switch to incorporate a qualitative paradigm into my research was difficult and daunting. But the more I read about the autoethnographic conceptions, the more enchanted I became with the methodological positioning of this research design and, eventually, sincerely believed that this was how I wanted to convey my experiences to the world. I chose to tell the story via the new thesis guidelines for Doctoral submission via manuscript or publication route as proposed by the College of Health Sciences at the University of KwaZulu-Natal. As an emerging academic and researcher the critique against this approach are very real within the positivistic approach as the paradigm wars continue. This has often challenged me to revisit my eager embrace of an autoethnographic approach in my own writing.

Since I am involved in the teaching, learning and research of anatomy at a higher-education institution in South Africa, I considered it relevant to examine and give an account of my experiences within my discipline. The context of this research is the University of KwaZulu Natal (Westville and Nelson R. Mandela School of Medicine campuses) where anatomy teaching, learning and research is the responsibility of the School of Laboratory Medicine and Medical Sciences in the College of Health Sciences. The University of KwaZulu Natal, based in the province of KwaZulu Natal in South Africa, is one of eight medical schools in the country. The University of KwaZulu-Natal was founded on 1 January 2004 as a result of the merger between the University of Durban-Westville and the University of Natal. The two KwaZulu-Natal universities were amid the first group of South African institutions to merge in 2004 in agreement with the South African Government's higher educational reformation plans that saw the number of higher educational institutions in South Africa reduced from 36 to 21 (http://www.ukzn.ac.za/; Accessed 21 October 2016).

This section begins with a contextual outline and motivation for the study, followed by the key research questions. A brief methodological outline which includes discussion of the research design, rigour and ethical considerations of this investigation is also presented in this chapter.

1.2 Background and rationale for the study

South Africa underwent a political transition in 1994 which signaled momentous changes in higher education directed by a vision of transformation, democracy, non-racism and non-sexism (Badat, 2010). According to the National Planning Commission (2012), it was vital to cultivate the next cadre of academics. Debowski (2012) stated that the import of being an academic and what comprises academic work are challenged and are constantly changing, due to the diverse forces that act on universities. According to Scrooby (2012), higher education in South Africa is fraught with constant demands. She states that pursuing a career as an academic is not a straightforward or automatic process. Adcroft and Taylor (2013) stated that academic work is fraught with multiple tensions through which academics must traverse. One such pressure is that of the conflicting demands placed on career academics' time and resources by research, teaching, community engagement and administration (Price et al., 2014). Educators are required to supervise more learners, motivate learners to ensure an effective throughput, be involved in more research, publish research articles, obtain increased external funding and cope with larger learner numbers in classes (Scrooby, 2012). It is against this backdrop that an introduction is presented which begins with a personalized description of my professional growth and development as an academic. This is done to introduce the challenges in the research, teaching and learning of Human Anatomy in the undergraduate programme and to convey my narrative through an autoethnographic lens.

1.3 Introducing 'me'

During my undergraduate career in the Bachelor of Medical Sciences Programme and then my postgraduate studies in the Masters Programme I had a curiosity for the fine art of medicine and the health sciences. I was appointed as a faculty member in 2006 and registered for the Doctor of Philosophy degree programme in Anatomy, which I believed would have afforded me the chance to attain a great degree of scholarly competence and to develop the ability to contribute to knowledge in the anatomical sciences. I was a scientist anatomist employed to teach gross anatomy- so, naturally, I wanted to pursue a doctoral study on cadaveric material with applied clinical import. Little did I realise that the discipline that I was so eager to join was faced with what seemed like insurmountable challenges and dilemmas such as the severe shortage of cadavers for research, teaching and learning within the discipline. As a result, pursuing a clinically-applied gross anatomy PhD within the discipline was unlikely. As an aspiring academic I engaged in several publications as a co-writer with clinical colleagues in specialist fields of cardiovascular, orthopaedic and neural anatomy and, in the process, I deepened my knowledge of my discipline. These past publications were as follows:

Cardiovascular anatomy
Absent left main coronary artery with variation in the origin of its branches in a South African population.
Ajayi NO, Lazarus L, Vanker EA, Satyapal KS
Anatomia Histologia Embryologia (2015) 44(2):81-85. doi: 10.1111/ahe.12109. Epub 2014 Mar 24.

The intramyocardial left anterior descending artery: prevalence and surgical considerations in coronary artery bypass grafting.
Vanker EA, Ajayi NO, Lazarus L, Satyapal KS.
South African Journal of Surgery. 2014 Feb;52(1):18-21

Double aortic arch: an unusual congenital variation.
Satyapal KS, Lazarus L, Shama D.
Surgical and Radiologic Anatomy. 2013 Mar;35(2):125-9. doi: 10.1007/s00276-012-1030-z. Epub 2012 Oct 13.

Case of Double Superior Vena Cava
B. Singh, L. Ramsaroop, J. Maharaj, A. Reddi
Clinical Anatomy 18:366–369 (2005)

Neural anatomy
Thoracic origin of a sympathetic supply to the upper limb: the 'nerve of Kuntz' revisited.
Ramsaroop L, Partab P, Singh B, Satyapal KS.
Journal of Anatomy. 2001 Dec;199 (Pt 6):675-82.

A thoracoscopic view of the nerve of Kuntz.
Ramsaroop L, Singh B, Moodley J, Partab P, Pather N, Satyapal KS.
Surgical Endoscopy. 2003 Sep;17(9):1498. Epub 2003 Jun 17.

Galen's "Anastomosis" revisited
Naidu L, Ramsaroop L, Partab P, Satyapal KS.
Clinical Anatomy. 2011 Dec 12. doi: 10.1002/ca.22011. [Epub ahead of print]

Osteo-anatomy
Acromial morphology and subacromial architecture in a South African population
N Naidoo, L Lazarus, SA Osman, KS Satyapal
International Journal of Morphology – IJM 024.15

An anatomical investigation of the carotid canal
N Naidoo, L Lazarus, NO Ajayi, KS Satyapal
Folia Morphologica, Manuscript number: FM #38880

It was at this moment in my life that I decided to embark on a postgraduate diploma in higher education as this would allow me the opportunity to initiate my interest in the scholarship of education generally. My struggle to find a distinctive research design was not unique. Like several other researchers, endeavouring to research in the field of one's work, I struggled to determine, articulate and decide on an appropriate methodology. I was in a conundrum- being an academic and knowing that I had to attain my postgraduate qualification! I often found myself as did Petersen (2007; p 476), "working and policing at the boundaries of 'academic', and 'myself-as-this-particular-kind-of-academic-in-this-particular-context'." My supervisors introduced me to the emerging methodological approach of autoethnography in Health Sciences education. On reflection of the challenges I had experienced in the discipline, I chose to tell my story via autoethnography as it allowed me the latitude to highlight my research, teaching and practices as an anatomy educator.

1.4 Key questions of this research

The purpose of this study was to examine the praxis and research of human anatomy education through autoethnography. In the context of this thesis, the term 'praxis' as defined earlier is a "process by which a theory, lesson, or skill is enacted, practiced, embodied or realized" (Morse, 2017 (e-book) ; p. 718). It refers to research practices as well as the teaching and learning (pedagogy) of human anatomy.

How can autoethnography explain research and praxis in anatomy?

The core of this question was to use autoethnography to elicit fine-grain data to understand praxis and research in the domain of human anatomy.

How does research and praxis occur in human anatomy?

In responding to the second critical question, the study interrogated the perspectives of nodal informers (co-authors) regarding the teaching and research of human anatomy using collaborative autoethnography. The study further examined the views of Senior Faculty in Anatomy Departments in Southern Africa regarding their opinion towards their own subject and its objectives (including research) and interrogated students' experiences of learning human anatomy through reflections of their interactions with the cadaver via journal writing and m-learning experiences. A summary of the critical questions, the manuscripts that respond to each of these questions and the respective research approaches are outlined in Table 1.

Table 1: Overview of manuscripts in thesis: Research approaches

RESEARCH QUESTION	MANUSCRIPT TITLE AND NUMBER	RESEARCH APPROACH	SAMPLE AND CONTEXT	RESEARCH INSTRUMENT	DATA ANALYSIS APPROACH
How can autoethnography explain research and praxis in anatomy?	1. Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating From a Selected South African University	**Qualitative** (Denzin, 1997; Ellis and Bochner, 2000; Ellis, 2004; Anderson, 2006; Chang, 2008)	The Self	• Memory • Reflection	**Autoethnography** (Denzin, 1997; Ellis and Bochner, 2000; Ellis, 2004; Anderson, 2006; Chang, 2008)
	2. Communities of practice: a new methodology in anatomical research and teaching	**Qualitative** (Ngunjiri and Hernandez, 2010; Chang et al., 2013)	Nodal Informers (Co-authors) National and International Co-authors	• Interviews • Open-ended Questionnaires	**Collaborative autoethnography** (Ngunjiri and Hernandez, 2010; Chang et al., 2013)
How does research and praxis occur in human anatomy?	3. Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education	**Qualitative** (Cresswell, 2003; Egbert and Sanden, 2014)	**National faculty** • Sefako Makgatho Health Sciences University • University of Cape Town • University of the Free State • University of KwaZulu-Natal • University of Pretoria • University of Stellenbosch • University of the Witwatersrand	• Open-ended Questionnaires	**Thematic analysis** (Braun and Clarke , 2006; Vaismoradi et al., 2013)
	4. Reflective Journals: Unmasking student perceptions of anatomical education	**Qualitative** (Cresswell, 2003; Egbert and Sanden, 2014)	MBChB II students B. Medical Science, B. Physiotherapy B. Occupational Therapy Undergraduate Programme, University of KwaZulu-Natal	• Reflective journals	**Thematic analysis** (Braun and Clarke , 2006; Vaismoradi et al., 2013)
	5. 'Anytime, Anywhere'- Tablet technology in medical education	**Qualitative and Quantitative** (Cresswell, 2003; Egbert and Sanden, 2014)	MBChB II Undergraduate Students, University of KwaZulu-Natal	• Closed- and open-ended questionnaire	Qualitative data: Thematic analysis Quantitative data: SPSS Version 21.0.

1.5 Materials and Methods

A discourse on the research approach used in this thesis is discussed in this section. This has been prepared to validate the choice of the research method, the data collection process and the applied data analysis for each of the manuscripts in this thesis. This section describes the methods which are common for the different studies in this thesis, viz. qualitative and quantitative methods. It also explains the rationale behind the chosen methods.

1.5.1 Quantitative vs. Qualitative methodology

The research field of medical education has a variety of approaches. Quantitative methodologies are targeted to gather information that delivers responses to specific questions. Participants are often randomly chosen and assigned, and data is numerically based and analysed statistically (Egbert and Sanden, 2014). Cresswell (2008) states that qualitative research approaches permit for the collection of information that stimulates an in-depth understanding of particular phenomena. Often qualitative and quantitative methodologies are viewed as opposites, as qualitative methodologies are considered to involve greater subjectivity on the part of the researcher whilst quantitative methodologies are more objective in the researcher's quest to uncover the 'Truth' (Egbert and Sanden, 2014).

Positivism is the most common paradigm, but interest in qualitative approaches have increased (Bunniss and Kelly, 2010). The overwhelming majority of published anatomical research projects are quantitative in nature or utilise a mixture of both quantitative and qualitative techniques (Traser, 2016). Although still regarded as 'inferior' by many basic scientists, the purposeful inclusion of purely qualitative research projects into the anatomical-education discipline would provide researchers with rich insights not easily gained through quantitative or even mixed methods designs. By definition, a qualitative study uses observations, interviews, and document analyses to investigate a specific event or phenomenon (e.g., a person, class, process, or institution) and results in the production of a rich, descriptive interpretation of the studied event and is typically analysed for patterns and tendencies (Traser, 2016). Crotty (2003) reports that either of these approaches may be used which are dependent on the information required. Maxcy (2003) also advocates for mixed methodology, citing a combination of both qualitative and quantitative viewpoints in integrating material to address specific circumstances.

Mack et al (2005) provide a summary of the essential differences between quantitative and qualitative data in Table 2.

Table 2: Comparison of quantitative, qualitative and mixed method research approaches (Adapted from Mack et al., 2005)

	QUANTITATIVE	QUALITATIVE	MIXED METHODS
General framework	• Strives to confirm hypotheses about phenomena • Instruments are more rigid in style of eliciting and categorizing responses to questions • Use highly structured methods such as questionnaires, surveys, and structured observations	• Strives to explore phenomena • Instruments use more flexible style of producing and classifying responses to questions • Uses semi-structured methods such as interviews, focus groups and participant observation	• Strives to provide knowledge base on pragmatic grounds • Employs strategies of inquiry that involve collecting data either simultaneously or sequentially to best understand research problems
Analytical objectives	• To quantify differences, predict causal relationships and describe characteristics of a population.	• To describe variation, explain relationships, individual experiences and group norms.	• To provide a better understanding of a research problem or issue than either research approach alone.
Format of Questions	• Closed-ended	• Open-ended	• Both open- and closed-ended questions, both emerging and pre-determined approaches, and both qualitative and quantitative data and analysis
Format of Data	• Mathematical (obtained by assigning numerical values to responses).	• Textual (obtained from audiotapes, videotapes, and field notes).	• Multiple forms of data drawing on all possibilities
Study design	• Study design is constant from beginning to end • Participant responses do not influence or determine how and which questions researchers ask next • Study design is subject to statistical assumptions and conditions.	• Some aspects of the study are flexible (e.g. the addition, exclusion, or wording of particular interview questions) • Participant responses affect how and which questions researchers ask next • Data collection and research questions are adjusted according to what is learned.	• Statistical plus textual analysis

According to Denzin and Lincoln (2005) qualitative research is a sited activity that positions the spectator in the world. It consists of a set of informative practices that make the world visible. Qualitative researchers investigate phenomena in their usual surroundings attempting to interpret them in terms of the significance people bring to them (Denzin and Lincoln, 2005).

Qualitative research studies were used to explore senior anatomy instructors' opinions regarding the state of anatomical knowledge at their respective institutions, student experiences of anatomy through an analysis of their journal-reflective writings and to establish how learners at a selected medical school use their mobile devices. Qualitative methods were chosen because they allowed me to understand what

people infer from their experiences, what meaning they attributed to their experiences plus the context in which these experiences came from. This thesis is constructed using two types of qualitative methods viz. autoethnography and thematic analyses of collected data.

Four of the manuscripts in this thesis followed a qualitative research approach. These are:

- *Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education;*
- *Communities of practice: a new methodology in anatomical research and teaching;*
- *Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating From a Selected South African University; and*
- *Reflective Journals: Unmasking student perceptions of anatomical education.*

1.5.2 Mixed methodology

According to Bernard (2006), a mixed methods design is valuable to capture the best of both quantitative and qualitative approaches. The aim of this type of research is that both qualitative and quantitative research, together, offer an improved understanding of a research problem than can be gained from either research approach alone. According to Cresswell (2003) a mixed methodology approach involves the gathering of data either concurrently or consecutively to best understand research problems.

One of the manuscripts adopted a mixed methodology approach viz.

- *'Anytime, Anywhere'- Tablet technology in medical education.*

1.5.3 Autoethnography as method

In this thesis, autoethnography is used as a conceptual approach as well as a methodological construct and informs two of the manuscripts included in this submission (Table 1). Farrell et al. (2015) reports that autoethnography is derived from the discipline of anthropology and is considered to be a developing qualitative research approach in health professional teaching. It is an approach that allows the researcher to travel outside the autobiography of teaching and learning by uniting autobiographical accounts with a cultural inquiry and understanding (Farrell et al., 2015). The consequence is the production of new information about the culture in which the individual is located such that it can be eloquently pooled with others. Bunniss and Kelly (2010) report that autoethnography falls within the 'interpretivist' research paradigm as the methodology seeks to investigate the inter-relationships between the self and the culture, thus augmenting the ideology that knowledge can be regarded as a personal entity. This is a departure from customary research in medicine where research is commonly aligned with a positivist philosophy (Wall, 2006). By engaging in autoethnography, researchers explore their native cultures

(Chang, 2008). Finlay (2008) states that researchers report on this culture using reflective practice comprising both personal reflection and social evaluation.

Anderson (2006) emphasized five key tenets of the autoethnographic methodology viz. that the researcher must: (i) be fully involved in the social world under investigation; (ii) participate in reflection to evaluate data on self; (iii) be fully immersed in the text; (iv) have discussions with informants beyond the self; and (v) be dedicated to theoretical analysis. According to Ellis (2004), autoethnography allows for the understanding of how an idea or theory works in practice from an 'insider' source. Autoethnographic research necessitates that the researcher is an involved member of the culture under investigation, utilizing tools such as recordings and reflections to examine interactions between learners and the investigator in the investigator's teaching and learning cultures (Anderson, 2006).

The two manuscripts on autoethnography respond to the first critical question regarding the use of this methodology in the research and pedagogy of human anatomy (refer to Table 1). Two components of autoethnography viz. memory and reflection were used to construct these two manuscripts. It is this interest in reflexivity that has directed my exploration of analytic autoethnography. During the process of analytic autoethnography, "*ethnographic and narrative inquiry approaches are used to seek cultural understandings of autobiographical experiences, where the researcher is also the subject*" (Struthers, 2012; p 11). This methodology emphasizes the significance of analytic reflexivity, which draws on theories to explore the researcher's insider perspective. Analytic reflexivity illustrates how the researcher's memories combine with aspects of theories to construct their knowledge of particular events. According to Anderson (2006) and Chang (2008), the use of existing theories as a method of evaluating memories of events is claimed to improve the objectivity of the investigation. In this study, an analytic style of autoethnography is employed to mirror how knowledge within educational theories are used in professional practice to offer interpretations of the research, teaching and learning of human anatomy.

1.5.3.1 The use of memory in autoethnography

Recitation of remembrances as stories may be regarded as an age old human trait (McKenzie, 2007). Memory work allows us to make meaningful linkages between the experiences of the personal and the cultural as we recall past episodes of our 'cultural situatedness', thus permitting us to make sense of our present selves (Kuhn, 1995). As I am the research subject, interpretive analysis involves self-reflexive probing of my own expectations and conceptual frameworks, embedded in narratives of past events (Quicke, 2008). Hayano (1979) points out that it may be disadvantageous for the researcher as he or she is also the research subject, as familiarity with data collection and analysis processes may result in assumptions being taken for granted. I maintain that the role of my more objective education trained supervisor will guarantee that the emphasis of the study is kept in areas which may otherwise be taken

for granted or evaded in this study. I have implemented Anderson's explanation of analytic reflexivity as it is outlined within the context of analytic autoethnography which

> "*involves an awareness of reciprocal influence between ethnographers and their settings and informants. It entails self-conscious introspection guided by a desire to better understand both self and others through examining one's actions and perceptions in reference to and dialogue with those of others*" (Anderson, 2006; p. 305).

Buzzard (2003) and Delamont (2007) suggest that dependence on memory to harvest data can be challenged to determine its trustworthiness. To initiate the collection of introspective data for this themed analytic autoethnography regarding the use of self as an anatomy educator, experiences from my memory relating to research and teaching were prompted by working through the completion of Chang's (2008) reflexive exercises. I have used timelines to legitimise the use of memory in my research approach.

My 'self'encompasses all of my life experiences, including my career as an anatomy educator. The timeline serves as an orientation point to contextualise linked aspects of my life's journey (Muncey, 2005). Sandelowski (2011) states that, making diverse choices at different times in a person's life, strengthens the situatedness of data. The timeline exercise is clear in illuminating the association of my experiences with social and historical events to my use of 'self' in research and teaching practices.

1.5.3.2 Personal reflection

Personal reflection is viewed as a procedure whereby an individual evaluates his or her personal attitudes, principles, and expectations critically (Mamede and Schmidt, 2004). This procedure allows the individual to achieve an appreciation of their character, and may afford avenues to alter their attitude to life, thought processes, and behaviour patterns. The practice of personal reflection allows the individual to allocate meaning to their experiences and nurtures an in-depth appreciation of the real and symbolic feelings expressed through communication with others as suggested by Charon (2001). She further adds that by reflecting on the subjective and skilled aspects of our lives, we are better able to realize, interpret, and be stimulated by the experiences in which we engage. Kenyon and Randall (1997) argue that our lives are made up of a sequence of stories, which include stories about the past, present and future. By reflecting on these stories, we enrich our lives.

I have used memory and personal reflection in the construction of the manuscripts entitled "*Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating from a selected South African University"* and "*Communities of practice: a new methodology in anatomical research and teaching*."

1.6 Study context

The studies were conducted primarily in KwaZulu Natal which is one of the nine provinces in South Africa (Figure 1). Where the views of national faculty were sought from the eight medical schools in the country, this has also been identified in Figure 1.

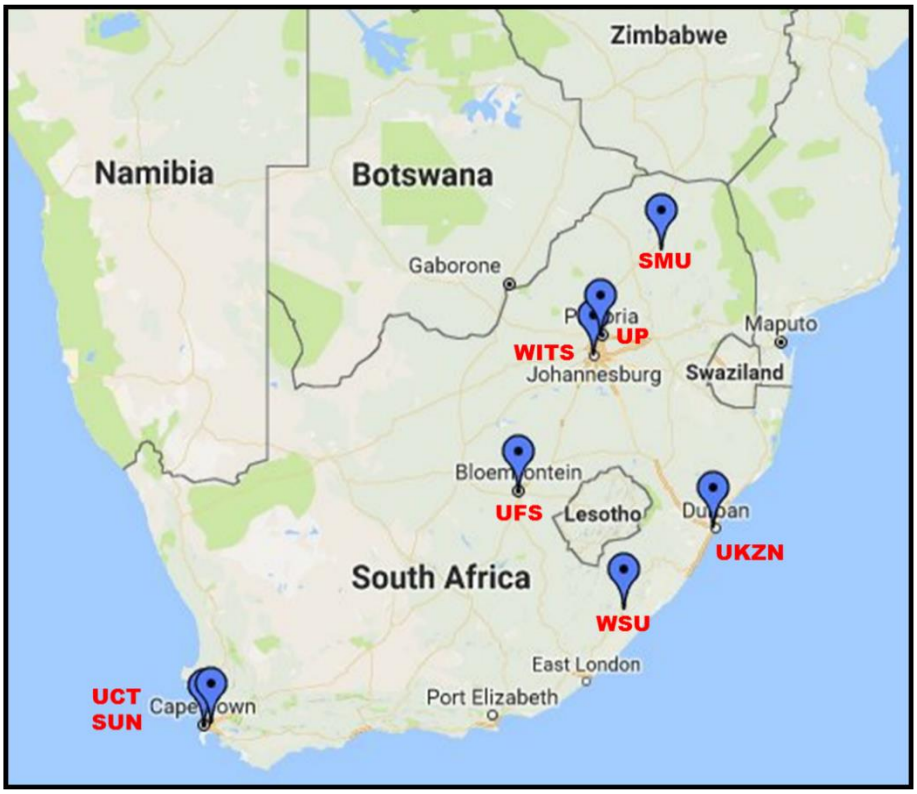

Figure 1: Map illustrating the position of the eight national medical schools in South Africa *(Adapted from www.google.com/mymaps)*

Key:

UKZN	-	University of KwaZulu Natal;
WSU	-	Walter Sisulu University
UCT	-	University of Cape Town
SUN	-	Stellenbosch University
UFS	-	University of the Free State
WITS	-	University of Witwatersrand
UP	-	University of Pretoria
SMU	-	SefakoMakgatho Health Sciences University

1.7 Data sources and collection strategies

Evaluation is the method of systematically gathering data that represents the views and experiences of its participants or other stakeholders for all the manuscripts in the thesis. The primary data sources in this study included the researcher herself, as both participant and teacher, co-authors on collaborative

papers identified as nodal informers, students enrolled in the anatomy course and faculty based in Anatomy Departments at Medical Schools in South Africa. The main data collection methods used in this research study were the literature reviews, semi-structured interviews, open and close ended questionnaires and reflective journals.

Data was collected in different ways and forms (Table 1). In each manuscript, data collection was explored extensively. This thesis utilised three methods for the collection of qualitative data viz. semi-structured interviews and free-text comments on open-ended questionnaires (see Appendix A for detailed interview schedule). Participants were able to lead the discussion, framed around their understanding of the problems and events. Additionally, this approach enabled the researcher to explore unexpected issues as they arose. Quantitative data was collected via closed-ended questionnaires (see Appendix A for detailed interview schedule). A mixed-methods approach using both open- and closed ended questions was utilised in the "'*Anytime, Anywhere'- Tablet technology in medical education*" manuscript.

1.7.1 Interviews

Interviews are techniques of gathering information through verbal inquiry utilizing a set of pre-planned key questions. According to Shneiderman and Plaisant (2005), interviews can be very valuable since the interviewer can follow specific matters of concern that may lead to focused and productive suggestions. Genise (2002) and Shneiderman and Plaisant (2005) suggest that the main advantages of interviewmethods of data collection are that:

a) there is direct interaction with the users which leads to unambiguous, constructive ideas;
b) they are good at procuring detailed information; and
c) few participants are required to gather rich and thorough data

Depending on the requirements and design, interviews can be unstructured, structured, and semi-structured with individuals. I chose to use semi-structured interviews to obtain the relevant data in this study.

1.7.1.1 Semi-structured interviews

This method of interview uses both closed and open ended questions. In order to be constant with all participants, I had a list of pre-planned core questions for guidance to ensure that the sameareas were covered with each interviewee. As the interview progressed, the intervieweewas given the occasion to elaborate or provide more relevant information if he/she optedto do so. This study used the semi-structured interview approach on the following participants in the respective manuscript: "*Communities of practice: a new methodology in anatomical research and teaching.*" The nodal academic moments

encountered in my life pertained to the interdisciplinary collaboration that I have enjoyed with my colleagues which has resulted in good research output and has contributed to my professional development as an emerging anatomist. I have selected three nodal areas of investigation from the manuscripts that I have co-authored and categorized them into key areas viz. cardiovascular anatomy, neural anatomy and osteo-anatomy (The titles of these manuscripts are listed in Appendix A). The co-authors of these papers are referred to as nodal informers in this thesis.

1.7.1.2 Questionnaires

The survey is regarded as a key data collection method in health research (Crombie and Davies, 1996). The majority of such surveys included closed-ended questions where respondents are asked to select from a fixed number of possibilities (O' Cathain and Thomas, 2004). These were thought to be well-organized because data was easy to gather, code and analyse (Fink and Kosecoff, 1996). One of the advantages of using a self-administered questionnaire is that all respondents get the same questions and there is no concern about interviewer bias (O' Cathain and Thomas, 2004). Bernard (2006) reported that many survey researchers utilise the open-ended format for intimidating questions. Open-ended electronic questionnaires were utilised in the manuscript entitled "*Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education."* These questionnaires were disseminated to senior national faculty based in Anatomy Departments at the eight Medical Schools in South Africa (Figure 1) via the Anatomical Society of Southern Africa. A detailed outline of the questionnaire schedule is appended in Annexure A.

According to Brysman and Burgess (1999), a mixed method approach using a combination of both quantitative and qualitative methods can be utilized in a single research project subject to the kind of study and its methodological underpinning. The study entitled "*'Anytime, Anywhere'- Tablet technology in medical education"* utilized a questionnaire comprising both open and closed-ended questions.

Some researchers such as Steckler et al. (1992) and Bankauskaite and Saarelma (2003) consider replies to general open questions to be qualitative data but others such as Boulton et al. (1996) do not. Murphy et al. (1998) suggest that open-ended questions can be described as 'quasi-qualitative data'. Open questions have some of the characteristics of qualitative methodsas they seem to allow respondents to write whatever they want in their own words, with little structure levied by the researcher; the output is comprised of words rather than numbers or ticks, the analysis may use techniques related to qualitative research; and publication can involve the display of verbatim quotes (O' Cathain and Thomas, 2004).

1.7.2 Reflective journals

In this thesis, reflective journals were used as the research instrument in Manuscript 4, entitled "*Reflective Journals: Unmasking student perceptions of anatomical education*." Walker (2006) posited that there is no correct definition for journal writing due to the many number of ways in which it can be used. For the purposes of this study, journal writing referred toany writing that students performed during classroom experiences that challenged them to reflect on past situations, including prompting them to consider how they would have performed differently if a similar situation arose in future. Before journals were issued, I conveyed to all learners the potential benefit that such an exercise should they chose to participate (Brown and Sorrell, 1993; Kobert, 1995). As stated by Kobert (1995), every effort was made to ensure that the journal writing was seen as non-threatening and satisfying. Journals were distributed to all Physiotherapy, Occupational Therapy, 2nd and 3rd year B. Medical Science and 2nd year MBChB students of the University of KwaZulu Natal at the beginning of an academic term. These students were involved in full-body dissection throughout an academic year. All students were informed of the purpose of the exercise. Students were requested to reflect on their learning of anatomy, including their views on their practical sessions which comprised of interactions with the cadaver. Students were guided on the sorts of issues to write about such as:

- Their views about the course and their progress;
- Their experiences about interactions with the cadaver;
- Changes in enthusiasm or approach towards their learning;
- Thoughts about how to learn successfully;
- Perceptions or areas that had challenged them. What did they find difficult ...and why?
- Areas that they found easy ... and why?
- What knowledge they required to improve; and
- What skills they needed to develop?

These questions provided focus to enable students to concentrate and not feel pressured into writing. Informed consent was taken from all participants. Journals were collected at the end of the academic term and analysed as follows: All narrative interpretations were categorised and organised into themes.

1.8 Data analysis

All interviews were tape-recorded data and transcribed into an electronic format.All transcripts emanating from interview and free comments from open-ended questionnaires were analysed using a thematic approach (Creswell, 2008; Merriam, 2009).

Before data analysis, I immersed myself in the data by reading all transcripts. This provided a general overview of the data collected. Data were analysed using open, axial and selective coding (Cresswell, 2007). Coding was conducted by researchers independently. Throughout this process researchers constantly compared the transcripts. Once the transcript had been read from start to finish, I revisited the transcript. This time, statements ofinterest, or relevance to the research question were highlighted. For each statement a keyword was assigned. Keywords were deliberated on in relation to both the statements and research question and codes were allotted. Codes allowed me to categorise statements. All transcripts were analysed in the same format. I then engaged in axial coding where relationships between codes were deduced and thematic and sub-thematic areas were identified. Cohen et al. (2011; p561) define axial coding as a "category label ascribed to a group of open codes whose referents (the phenonema being described) are similar in meaning." Axial coding links related codes and subcategories into a larger category of common meaning that is shared by a group of codes in question. In this study, this process was used in the determination of themes and sub-themes for the manuscripts. During selective coding, the main themes were finalized and illustrative quotes were selected. Where quotes have been incorporated in the chapters of this thesis, they are tagged with identifiable data. Informed consent from participants allowed me to do this.

For the mixed-method approach utilised in the manuscript entitled "'*Anytime, Anywhere'- Tablet technology in medical education*", quantitative data was analysed using the statistical software package of SPSS version 21.0. Descriptive statistics of the quantitative data for comparison of categorical variables of frequencies and cross-tabulations were performed using the Pearson's Chi-squared test (X^2).

1.9 Reliability

Reliability, with respect to qualitative methodologies, is problematic (Merriam, 2009). This is principally because human behaviour is not static, nor is one opinion more likely to be correct over another. In quantitative terms, reliability is achieved when a study can be repeated yielding the same results (Vanderstoep and Johnston, 2009). For qualitative research, replication may never be achieved. This does not discredit the data as it should be acknowledged that data can yield many interpretations. In light of this, the reliability of qualitative data comes from asking whether results are consistent when

the data is collected (Merriam, 2009). Consistency in data analysis for this thesis was achieved by using a minimum of two researchers to analyse data independently.

1.10 Validity

Validity in qualitative research refers to the "appropriateness" of the tools, processes, and data utilized in the research process (Leung, 2015). Cohen et al. (2011; p 179) states that validity is based on the view that it is in essence a demonstration that "a particular instrument in fact measures what it purports to measure, or that an account accurately represents 'those features that it is intended to describe, explain or theorize." Cohen et al. (2011) further suggest that in quantitative research, validity may be enhanced by careful sampling, suitable instrumentation and appropriate statistical treatment of the data. Validity is the degree to which results of a study can be applied to other situations (Vanderstoep and Johnston, 2009) i.e. the capacity to generalise. It is due to this seeming lack of capacity that qualitative research is occasionally dismissed. Generalising the results of a qualitative investigation is difficult, as the sampling is often purposive, and findings are largely contextual. The validity of a qualitative study therefore comes from the transferability of the results (Merriam, 2009). It has been suggested that the best way to achieve transferability is to paint a full picture of the background and results of the study by providing a thick description of the context so that the reader may assess similarities between them and the study (Lincoln and Guba, 1985). Another recommended technique to improving transferability is a careful selection of the study sample. Merriam (2009) suggests that allowing variations in a sample will allow the study to be applied to a wider population. These variations can be achieved by increasing the locations used for a study, selecting more respondents or choosing the usual sample of participants (Merriam, 2009). In order to make the findings of the studies in this thesis transferable, I have, where appropriate, used as large a sample size as possible and included participants from other institutions within the country. This enabled the findings to be considered out of the culture of the University of KwaZulu Natal, as indicated in the manuscript *"Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education."*

1.11 Transferability

Transferability can be defined as the extent to which a set of findings are relevant to settings other than the ones from which they are derived (Lincoln and Guba, 1985). This can be achieved by the collection of detailed rich thick descriptions, which must be accompanied by convincing analysis and interpretation (Hull, 1997).

This methodology allows the first author to critically reflect on her multiple roles as an observer, professional educationalist and participant in interdisciplinary research that can be used to express and

share real-life perspectives and experiences to have transferable implications for other academic identities. In addition, the findings obtained in this study were obtained from a wide array of stakeholders externally (nodal informers and staff teaching anatomy at other academic institutions in South Africa) as well as from internal stakeholders (academics who serve as co-authors of papers and students).

1.12 Ethical clearance

Silverman (2000) states that when researchers are engaged in their research, they need to be cognisant of the fact that they are essentially moving toward the private spaces of their participants. As a result, ethical issues require to be addressed before the actual research is performed. Creswell (2003) reinforced this by concluding that it is the researcher's responsibility to respect the needs, rights, values and desires of the participants.

Prior to the start of field work, an ethical research proposal was submitted to and approved by the Biomedical Research Ethics Committee of the University of KwaZulu Natal. The explorations in this study addressed the following ethical issues: Firstly, the participants were guaranteed of confidentiality via the use of non-identification in the respective studies and in the thesis; Secondly, the participants were educated of their rights to participate, or not, in the study. They were also informed that they stood to benefit from the study as the key questions in the study would encourage them to reflect on their practices as educators and students; Thirdly, transliterated interviews were stored in password-protected files in the Department of Clinical Anatomy, University of KwaZulu Natal with limited access and kept on a hard drive to which only I had access; and fourthly, participants were informed of the objectives of the research and informed consent from all respondents were sought and obtained.

This study adhered to the institution’s policies regarding ethical clearance and ethical approval was granted by the University of KwaZulu Natal’s Biomedical Research and Ethics Committee (BE386/15) (Appendix B). Theethical status for each study is outlined in the Materials and Methods section ofeach manuscript.

1.13 Structure of thesis

This dissertation is presented in manuscript format and is comprised of the background in Chapter one, theoretical framework in Chapter two, data presented in Chapters three, four and five, presenting a synthesis of the data chapters. Interfacing pages have been included between chapters to demonstrate how they are linked. The linking thread between manuscripts is the praxis and researching of human

anatomy. A background has been included in order to orientate the reader to the overall view on the aims of the study. Each chapter in this thesis has been titled and begins with a relevant quotation.

Chapter one provides an introductory insight into the thesis, where an analysis of the title and setting the scene for the thesis is offered. A brief general methodology of the study including the overall study design also forms a component of this chapter.

Chapter two provides an outline of the relevant literature based on the topics that have been addressed in the studies. Educational-theoretical frameworks which underpinned the manuscripts included social constructivism, situated learning, communities of practice and informal learning.

Chapter three offers a compilation of two manuscripts ("*Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating from a Selected South African University and "Communities of practice: a new methodology in anatomical research and teaching"*) that have been submitted to accredited journals for publication. This chapter aims to provide clarity on the research and praxis of human anatomy from an auto ethnographic perspective which is an invisible thread that runs through this chapter and offers texture in its presence.

Chapter four contains a compendium of three manuscripts, one of which aims to highlight the patterns of social and emotional responses to cadaveric dissection, and complex and iterative patterns of learning ("*Reflective Journals: Unmasking student perceptions of anatomical education*"). This chapter also contains a manuscript which aims to illicit faculty perceptions of students' knowledge of anatomy ("*Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education"*) and the remaining manuscript aims to determine learner use of mobile devices *("'Anytime, Anywhere'-Tablet technology in medical education*).

Chapter five provides a summarized graphic representation of results linked to epistemological stances for all five manuscripts. A conceptual framework for the research and praxis of human anatomy is offered. Future research ideas are recommended to the readership.

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CHAPTER 2

Literature Review and Theoretical Framework

2.1 Prelude to chapter

The ensuing section contains an appraisal of the literature and theoretical components that are pertinent to this research study. The appraisal begins with a general discussion about autoethnography and its use in medical education followed by the value of research collaboration. The review continues with faculty perceptions of their discipline and follows with student perceptions of their learning environments and concentrates on the debates between traditional anatomy teaching and modern methods for teaching the subject. The use of technology in medical education provides a penultimate review. The appraisal concludes with a review of educational theories as they are applied to anatomy education. Although a review of literature and theory has been completed in the different manuscripts, these have been done summarily. A more comprehensive submission is necessary given that all of these aspects have impacted on praxis and research in human anatomy in different ways and have contributed to the emergence of the final thesis.

The first conceptual and methodological idea is autoethnography which involves the researchers' recollection and reflection.

2.2 Autoethnography

Autoethnography is a qualitative method used to research and write about descriptions and systematic analyses (graphy) on personal experience (auto) in order to gain an understanding of cultural experience (ethno) (Ellis, 2004; Holman Jones, 2005). Autoethnography involves the researchers' recollection and reconstruction of stories through memory work. Chang (2008) suggests that memory is both a friend and foe. In the following section, I argue that the factors influencing my world, when assembled together, created a balance of research process (graphy), on culture (ethno), and on the self (auto).

In the autoethnographic field, it is essential to offer a brief description of the researcher's life as it relates to the study so that the reader may understand the setting within which the researcher presents the data (Ellis and Bochner, 2000). This autoethnographic description adopts and includes predominant voices of nodal informants as well as my own voice. These voices merge and feel right together as they form part of my regular, everyday space. These are people that I have interacted with either on a daily basis or at scientific meetings, and with whom I have shared the trials and tribulations of my teaching and research expertise. I recall the journey very well. Now as I read for this PhD, the journey takes on a feel and tone of its own. In one of my many readings, I came across a fitting quotation "When you are preparing for a journey, you own the journey. Once you've started the journey, the journey owns you" (Slope, 2006; p. 165).

At first, it was the works of Reed Danahay (1997) and Ellis and Bochner (2000) that inspired my journey into this new approach and I soon realised that, not only, was autoethnography a suitable methodology, but was also the only way to present an important cultural phenomenon that I was living and researching. At the very core of my study lived my own self-awareness and commentary of my experiences and introspections are regarded as a primary source of data. I have chosen to deliberately write some parts of this account in the first person as I believe that writing in the first person brings with it a personal responsibility, a dynamic voice, presenting a reliable description of experiences, which contains both difficulties and strengths (Ellis and Bohner, 2000).

Autoethnography, as described by Ellis and Bochner (2000: p.739), is a category of writing that "displays multiple layers of consciousness connecting the personal to the cultural." These authors claim that the differences between the cultural and the personal turn out to be unclear as the author changes the focus and moves back and forth between looking outward and inward. I realise that I am changing as an individual and as a researcher and I will utilize my experiences to gather understandings of the larger culture of which I am a component of. According to Hayler (2011), autoethnography has gradually developed into a research approach for an assortment of research methods, analyses and writings that employ personal understandings as a means of examining and appreciating the cultures of the societies that we live and work within. The research tools used in this methodology focus on the use of "memories of events, feelings, thoughts and emotions which contribute through varying methods of recall, collection and analysis towards different types of systematic introspection in order to illuminate and to facilitate understanding" (Hayler, 2011; p.19).

I borrow from Roth (2005; p.9) who enunciates my private fears states that "autobiography and autoethnography could easily lead us into the mires of fuzzy thinking, will-of-the-wisp inspiration and self-congratulatory, feel-good accounts of world events." He continues, maintaining that "by advocating autobiography and autoethnography as a means of generating understanding in education, we do not intend to support self-indulgence, ideology and prejudice." Roth (2005: p. 10) claims that conducting research using these approaches must be performed in a disciplined, systematic and rigorous manner "lest auto-biography and autoethnography lead to ideology, delusion and conceptual blindness" (Roth 2005: p. 9).

As an aspiring academic researcher these criticisms are serious and often challenged me to re-consider my enthusiastic embrace of an auto/ethnographic approach to my own research writing.

2.2.1 An 'anatomical turn' in medical education

In presenting autoethnography in medical education, the following section examines the literature of this emerging research approach. According to Foster (2013: p19), the term 'narrative' which is used to describe the "use of stories to construct meaning from events," is a principle way through which individuals make sense of the world; it is also regarded as a standard technique through which cultures express messages regarding what is valued and what is significant to a cultural group (Morris, 1998; Mattingly and Garro, 2000). According to Bochner (1994) and Denzin (1997), the term "narrative turn" used in the social sciences gave rise to the research method of autoethnography in which accounts of personal experience are investigated as a part of a given culture. I use Bochner (1994) and Denzin (1997) to forward a similar idea in the examination of human anatomy given the move away from clinical investigations, in coining the notion of an "anatomical turn". Ellis and Bochner (2000), and Ellingson and Ellis (2008) describe autoethnographic research as a methodology that includes the strictness of both creative and reflective analytical procedures. Foster (2013) reports that in the initial stage of autoethnographic exploration, the researcher develops a redolent individual narrative and during the second stage, the investigator interrogates the narrative and makes connections between the story and a broader cultural configuration. The researcher undertakes numerous rounds of writing and analysis as the "findings" of the study develop. Autoethnography has been utilised by scholars in diverse disciplines such as anthropology, sociology, education, communication, social work, and is an emerging approach in nursing and other medical disciplines (Foster, 2013).

2.3 Research collaboration as professional praxis

As far as research within departments is concerned, academics are exposed to entirely new environments for advancement and for getting things done. Gone are the days of the sole intellect quietly slogging away in pursuit of that 'Eureka' minute to transform an 'industry' According to Cummings and Kiesler (2007) and Bammer (2008), research collaboration has been a phenomenon of increasing importance for scientists and research organisations.

Collaboration is a practice through which people who see diverse aspects of a problem can beneficially explore their differences and search for explanations that are outside of their own limited vision of what is possible (Gray, 1989). Collaboration produces novel concepts and innovative results that emerge from the interaction of these perspectives, experiences and knowledge which assists us to perform our work from people both inside and outside an organization (Gray, 1989).

Katz and Martin (1997) and Bozeman and Corley (2004) report that collaboration occurs for a range of reasons such as to (i) access expertise or specific skills, (ii) access equipment or resources, (iii) promote

cross fertilization across disciplines, (iv) improve access to funding, (v) learn tacit knowledge. All of the afore-mentioned reasons are performed to obtain respect, acknowledgement, and the enhancement of student education.

Nodal moments are occasionally described as critical events or incidents. According to Sikes et al. (1985; p.57) critical incidents are "key events in an individual's life, and around which pivotal decisions revolve. They provoke the individual into selecting particular kinds of actions, which lead in particular directions." According to Reimer (2014), these critical occurrences represent a turning point in the progression of personal careers and at this point the individual realizes that "I am not the same as I was, as I used to be (Strauss, 1959; p.95)." In this study, nodal moments are described as my interactions with individuals with whom I have collaborated, in respect of research within my discipline. These collaborations have primarily been with fellow anatomists and clinicians. Such networking has been valuable as it has allowed for interdisciplinary expertise, shared learning, new research opportunities, the establishment of new research projects, joint applications for funding and technology transfer (Puljak and Vari, 2014). Building research networks are important in the context of my discipline where there are small research groups and scarce funding. The collaboration with my colleagues has resulted in an increased citation of research manuscripts dealing primarily with the concept of human anatomical variations (see Appendix A).

The presence of variations has long been witnessed in anatomy, but their significance has not always been fully acknowledged (Bergman, 1988; Bergman, 2011). Variations form an important component of the study of human anatomy. Each human body enjoys a unique configuration and has its own quota of variations. For many clinical specialties, the human body is the focus of examination and intervention on an everyday basis, and, therefore, an accurate knowledge of anatomy and individual variations is essential in warranting safe and effective clinical practice (Faselet al.2005; Raftery, 2006; Turney, 2007). Eizenberg et al. (2013) stated that any deviation in the configuration and position of anatomical features from the typical range of normality may be interpreted as an anatomical variation. Skandalakis et al. (2004) report that some anatomical variations have the potential to cause grave complications in accessing surgical planes resulting in confused surgeons whilst there are other variations that have the potential to cause diagnostic quandaries when interpreting medical imaging data. Clinically significant congenital anomalies or rare anatomical variations are discovered during routine laboratory dissection or during routine clinical procedures (Nieder et al., 2005).

According to Raikos and Dade Smith (2015), clinically significant information on anatomical variants is almost non-existent at the undergraduate level. Variations are encountered by students often during dissection classes but are unable to recognise them, and sometimes remove the variation to appreciate the normal pattern of anatomical structures; occasionally they report the finding to the anatomy demonstrators for further assistance (Raikos and Dade Smith, 2015).

The basic sciences are also thought to be important for preparing students for the future, as students who have a comprehensive knowledge of the structure and function of the human body (Leveritt et al., 2016) will probably deal best with advances in medical practice such as new diagnostic technology and surgical approaches (Monkhouse and Farrell, 1999).

Collaborative autoethnography shares all characteristics of solo autoethnography (Anderson and Fourie, 2015). Chang, et al. (2013; p. 23) describes collaborative autoethnography as "a qualitative research method in which researchers work in community to collect their autobiographical materials and to analyze and interpret their data collectively to gain a meaningful understanding of sociocultural phenomena reflected in their autobiographical data." Chang (2013; p. 28) further adds that "co-researchers collectively making meaning of personal stories can enable them to reach a deeper level of analysis, connect the stories to wider issues within the disciplines, link to existing literature, and overall provide the scholarly balance necessary to keep it from being mere navel-grazing." Although there are many examples of collaborative auto-ethography in situations of crises and where investigators are trying to make sense of their experiences (Radcliffe et al., 2013), we are unaware of collaborative accounts from investigators involved in anatomy education.

2.4 The Praxis and Research of Anatomy

2.4.1. Definition of concepts

In this section the core concepts are defined, followed by a discourse that examines traditional and modern methods of teaching anatomy. Finally, a section outlining the literature pertaining to a central question on 'how much of anatomy do they (students) know?' is presented.

Educator: An educator is defined as an individual "skilled in teaching; a student of the theory and practice of education, as well as an administrator in education (Scrooby, 2012; p.23)." In this research study the educator is the person who facilitates the praxis (teaching and learning) of the anatomy modules to students at a higher education institution in South Africa.

Higher education institution: The South African Government's *White Paper on Higher Education (1997)* describes a 'transformed' higher education system as one which provides equal admission and equally fair chances of success to all students and develops programmes leading to qualifications that meets the country's employment needs in respect of highly skilled alumni. The system should also promote critical and innovative thinking, patience and a pledge to the common good through its teaching, and produce research of an international standard that remains cognisant of African contexts

(Gravett and Geyser, 2004). In this investigation, the higher education institutions are the medical schools situated in South Africa.

Teaching: In this thesis, praxis includes the practice of teaching and learning. Teaching means the ability to help learners to acquire a particular skill. An educator can communicate with students about a certain subject, can assist students in practising a skill or help them discover knowledge for themselves (Scrooby, 2012). The educator can never learn for the students. According to Ehlers (2002), each student must be *aufait* with information, expertise and skills for their particular profession. Dubois (1998: p. v) defines "competency" as "those characteristics—knowledge, skills, mindsets, thought patterns, and the like—that when used whether singularly or in various combinations, result in successful performance." In this investigation, teaching takes place between the educator and the learner who attends an anatomy module at a higher education institution in South Africa.

Learning: Learning is an active, lively and collective process of knowledge construction that takes place through understanding and interpretation (Klopper, 2000). In this research study learning takes place between the educator and the learner and between the students themselves.

Anatomy: Anatomy is the study of the interior and exterior structure of the human body and includes the physical relationships between body parts (Martini and Bartholomew, 2007). In this thesis, anatomy refers to the gross anatomy of the human body.

2.4.2 Traditional vs. modern methods for teaching anatomy

In the following section it is argued that given the controversy surrounding the ethics, principles and practicality of using human tissue as a learning tool, there has been a paradigmatic shift from the traditional to an increased use of modern and alternative pedagogies.

Anatomical knowledge remains a foundation of medicine and the related health professions notwithstanding a drop in the importance of the subject, time allocations, and a decline in the status of anatomical education in modern curricula (Gillingwater, 2008). Anatomy teaching in medical schools has been customarily based around the use of human cadaveric specimens, either using whole body specimens for complete dissection or the use of prosected specimens (Cahill and Ettarh, 2009). Dissection strengthens and expands knowledge that is learnt in lectures and tutorials. Dissection allows for students to be exposed directly to human mortality. It helps in developing a three-dimensional and tangible appreciation for the human body that cannot be achieved by prosection alone or computerised learning aids (Agnihotri and Sagoo, 2010). In addition, the practice of cadaveric dissection allows students to grasp the spatial anatomy and the concept of biological variability (Winkelmann, 2007).

Students are able to visualise first-hand actual structures of the human body (Mulu and Tegabu, 2012). Dissection has also been recognised as the most worldwide tool, which is strongly supported for professional training and skills development (Arraez-Aybar et al., 2004; McLachlan et al., 2004; Azer and Eizenberg, 2007; Korf et al., 2008). However, some researchers believe that human anatomy can be taught effectively without students coming into contact with the cadaver (Oyeyipo and Falana, 2012). They state that medical students who learnt human anatomy by prosection and audio-visual material performed just as well in anatomy examinations as those who learnt by dissection (Druce and Johnsons, 1994; Nnodim et al., 1996b; Cahill and Leonard, 1997). More recently, there has been a lot of controversy surrounding the principles and practicality of using human tissue as a learning tool (Izunya et al., 2010). Further, as a result of current opinions related inter-alia on trying to balance learning outcomes, problems related to the use of human cadavers, teaching methods and resources, many recent curricula in anatomy have introduced a shift towards an increased use of alternative modalities of teaching using cadaveric plastination, non-cadaveric models and computer-based imaging (Snelling et al., 2003; Kerby et al., 2011). With technological advances and increased use of computer-tomographic scans and magnetic-resonance imaging, it has become increasingly common for medical schools to integrate much more radiology and cross-sectional anatomy into their curricula (Finn, 2010). Additionally, the use of cadavers for dissection in anatomy learning has been identified by some authors as being expensive, time consuming and potentially hazardous (Aziz et al., 2002).

Cadaver dissection has also been described as an emotionally-charged issue (Kennedy and Olson, 2009). Dissection of a human bodies during anatomy courses raises pertinent queries regarding the incursion of privacy, the source of cadavers and sensitive issues about death and dying (Cahill and Ettarh, 2008). Learners experience a variety of emotional reactions and mixed feelings when they encounter a human cadaver for the first time (Cahill and Ettarh, 2009). According to Dubhashi et al. (2011), a student's first exposure to human cadaveric dissection has the capacity to be an actual stressor which can lead to psychological trauma. Students also have to learn to overcome the offense attacks made on their senses such as the odour of the dissecting laboratory and the cadaver. (Godeau, 2009). Learners also have to become accumstomed to the global aspect of the cadaver because of its colour (Abu-Hijelh et al., 1997).

Against the decline in the status of anatomical education in modern curricula, a critical question emerges.

2.4.3 How much of anatomy do they know?

"For doctors, the human body is the focus of investigation and intervention on a daily basis" (Turney, 2007; p.104). Both anatomists and clinicians jointly agree that a solid and precise knowledge of anatomy and its distinctive variations is important to guarantee safe and efficient clinical practice (Bergman et al., 2011). Anatomy is a subject that is regarded as underpinning the development and maintenance of clinical knowledge and skills (Fasel et al. 2005; Raftery 2006). In the last decade, there have been increasing reports indicating that anatomy teaching is considered insufficient by students, teachers, junior doctors, and experienced clinicians (Tibrewal, 2006; Fitzgerald et al., 2008; Bhangu et al., 2010). Several authors have reported that the decline in anatomical knowledge of today's medical students may lead to medical errors (Patel and Moxham, 2006; Rainsbury et al., 2007; Kish et al., 2013). As the body of knowledge of medical sciences gains momentum, growing concerns are articulated about the volume of information in medical curricula and the "increase in factual overload" (General Medical Council, United Kingdom, 2003) due mainly to the integration of molecular biology and genetics into the undergraduate curriculum. Another commonly given justification behind this policy was that learners should be content-driven and not skills-based (Patel and Moxham, 2006). In South Africa, the Health Professions Council of South Africa has not arbitrated on a core anatomy curriculum and each University is responsible for the implementation for their own anatomy curricula. There is agreement that medical students certainly cannot be deprived of anatomical knowledge, although sentiments differ as to its scope (Bergman et al., 2014). The manner in which anatomy is taught to medical students has undergone major changes in recent years (Waterston and Stewart, 2005). The drop in anatomical knowledge has been repeatedly highlighted by authors who lay the blame for its decline on one or more of the following factors:

Anatomy is taught by non-medically qualified teachers

Anatomy plays an important role in the education and training of all health disciplines including providing a foundation for many programms in the biosciences (Fraher and Evans, 2009). Rizzolo and Drake (2008) report that the classical structure of medical schools and other institutes of graduate education have transformed from discipline-centered departments to interdisciplinary programmes and that the expertise of faculty retained in these traditional departments have also changed. There have been several discussions about how much anatomy should be taught and by whom, including when it should be taught in a particular career (Heylings, 2002; McLachlan and Patten, 2006; Azer and Eizenberg, 2007; Collins, 2008; Fraher and Evans, 2009). Despite the increasing growth and relevance of molecular sciences in modern curricula, anatomists are still of the view that the discipline embraces a central role in the teaching of the subsequent generation of clinicians, allied health professionals and scientists (Older, 2004; McCuskey et al., 2005; Winkelmann, 2007). In addition, current public curiosity and general interest in the structure of the human body has resulted in a realization that effective

anatomical education has to be resurrected and revived (Fraher and Evans, 2009). However, there is a growing lack of suitable educators to convey their knowledge, understanding and skill to junior faculty (McCuskey et al., 2005). In South Africa, medical schools have neglected Anatomy departments. This has led to an older population of Anatomy teachers, who have recently retired or are soon to do so. These faculty are not replaced by clinician-anatomists or "table doctors," (these are medically qualified individuals who are part of postgraduate training programmes) who in the past have acted as Anatomy demonstrators. Willan and Humpherson (1999) state that these annual postgraduate training posts are unattractive to trainees.

Moxham and Hanwell (2014) state that it is getting harder to find anatomists (with either clinical and/or scientific qualifications) who have a mastery of their discipline. They further report that faculty without relevant qualifications (and who are appointed in Anatomy departments) are hesitant "to invest the time necessary to master a subject that appears straightforward on the surface, but where it quickly becomes apparent that it requires a significant effort for a fuller understanding" (Moxham and Hanwell, 2014; 216). Van Mameren (2004) reports that faculty with degrees in molecular and cell biology or biochemistry are appointed in Anatomy departments since fundamental biology forms the current body of research in most of these departments. He further elaborates that molecular, cell biologists and biochemists cannot be a considerable source for experienced teachers of anatomy as they are not acquainted with teaching gross anatomy in connection with patient case related instruction.

Memon (2009) states that anatomy teaching faculty with PhDs in anatomical training are an endangered species in his country. This is a similar scenario at the Department of Clinical Anatomy at the University of KwaZulu Natal, where I teach. Of a total of eight faculty members housed in the discipline, only two are clinical anatomists. One has a PhD and the remaining five are currently credentialing towards a PhD (including myself). This reduction in the number of appropriately qualified anatomy teachers within the discipline and the challenges faced by faculty has resulted in an Executive position that embraces the philosophy that "any general scientist can teach anatomy."

In a study conducted by Kramer et al. (2008) of the eight medical schools in South Africa, three of these institutions admitted difficulties in obtaining suitably qualified faculty to teach anatomy. In their study, the percentage of faculty teaching anatomy ranged from 10-100 per cent and at one institution (which was not identified), all the teaching faculty were medically qualified and had Ph.D. degrees, highlighting the dichotomy of recruitment criteria at the different Institutions within the country.

The absence of a core anatomy curriculum and decreased time for anatomical education

Anatomy education faces a disadvantage as it is not afforded the time and resources necessary to ensure a teaching curriculum that is effective in providing evidence-based knowledge to students. Clinical

practice, like other medically based subjects, is an imperative skill that needs to be imparted in medical education. A clinician is required to examine patients on a regular basis and should have a thorough understanding of anatomy as this knowledge forms a basis for physical examination (Lockwood and Roberts, 2007). The interpretation of medical images (Allen and Roberts, 2002), as well as the ability to perform clinical procedures in a safe and effective manner (Fitzgerald, 2008), are both examples of the many tasks in a clinician's daily tasks that require a solid anatomical background. It should, therefore, be a fundamental subject within general medical training. According to Raftery (2007), there are increasing reports of cases of litigation in the United Kingdom originating from a lack of essential anatomical knowledge and training and its clinical application in surgery.

In light of the decreased contact hours with students, some medical educators advocate the implementation of a core-curriculum of the most clinically-relevant areas (Fincher et al., 2009; Craig et al., 2010). According to Orsbon et al., (2013), pre-clinical anatomy curricular recommendations have been established by surveying clinicians in a single specialty or through consensus opinions of groups of expert anatomists. A review of the literature reveals that although many clinicians value anatomy as the most important basic science, they appreciate and relate anatomical knowledge differently, depending on the specialty in question (Pabst, 2009; Arraez-Aybar et al., 2010). If a core anatomy curriculum were in place, teachers (both basic science and clinical) would be aware of what clinically applied anatomy that students were expected to know and it would assist learners in achieving that knowledge. A report published by Louw et al. (2009) describes an ideal anatomy course as having aspects of principles and problem based orientations included in the curriculum. Furthermore, it focuses on the definition of and distinction between 'general' and 'specific' anatomies, and how these can be taught by using diverse teaching approaches, learning resources and assessment programmes.

At the University of KwaZulu-Natal, the incorporation of anatomy into the medical curriculum has had a turbulent history. Over the last decade, there have been periods where the programme incorporated a prosection-based anatomy course only. Currently, the course entails dissection of anatomical systems within themes. Additionally, the current programme does not have a theme dedicated to Head and Neck Anatomy. The design of the curriculum is handled by a team of medical and non-medically trained scientists which forms the core expert group which generates guidelines on the content of the curriculum. Anecdotal reports from senior faculty at my University illustrate the lack of adequate anatomical knowledge of senior medical students, interns and registrars which prompted the initiation of this study.

Decreased use of dissection as a teaching tool

Anatomy teaching through the time-honoured approach of cadaveric dissection is decreasing, mostly due to time and/or money constraints (Bergman et al., 2011). The teaching methods used in anatomy

education can be categorised as the follwoing viz.: i) cadaver-related; ii) clinically-related; iii) computer/internet-related; iv) other related material (e.g. models or books); and v) other (e.g. lectures, practical classes, seminars, tutorials). Winkelmann (2007) conducted a broad review study to determine the effect of students' anatomical knowledge using both cadaveric dissection and the use of prosections (cadavers previously dissected by others). His study revealed that classical dissection seemed to propose a minor added advantage when compared to prosections. However, Biasutto et al. (2006) reported that best student performances were established in a group of students who learnt by both dissection and the use of computer resources.

According to a recent South African study by Dachs et al. (2010), interns demonstrated a particularly poor knowledge of anatomy in an assessment questionnaire. The authors suggest that the anatomy component should receive increased emphasis in the undergraduate curriculum as a good knowledge of anatomy is essential, not only to understanding any injury or disease process, but to also practise safely in any clinical medical field. Dachs et al. (2010) have suggested further studies to define why medical students perform poorly. He recommends a review of the curriculum including aspects like time allocation and content and cites teaching methods and teacher skills as being essential in ensuring that medical students obtain the knowledge and skills in their undergraduate training which will enable them to go out into the community and practise good medicine.

Further, a study conducted by Griffiths and Roberts (2005) illustrated that junior doctors were ignorant when it came to identifying correct anatomical landmarks for the safe insertion of intercostal chest drains; these would have been placed outside of the safe triangle as recommended by the British Thoracic Society.

A review of the above literature inspired me to write the manuscripts on autoethnography, viz.

"*Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating from a Selected South African University*" and
"*Communities of practice: a new methodology in anatomical research and teaching*"

Using the gross anatomy laboratory as an ideal setting, the next section explores the methodological stance of "reflection" by students about their learning of human anatomy.

2.5 Reflection in medical education

The term 'Reflective thinking' was first coined by John Dewey in 1933 to describe a mental process involving controlled, focused thought. Dewey (1933) was of the view that the need for reflective

thinking originated when individuals experienced baffling circumstances where doubt within these circumstances prompted the individual to make inquiries and find information to resolve the tension. According to Chan and Uhlmann (2015), individuals learn from experiences by reflecting on them. Reflection is therefore considered to be an important part of learning. Moon (2005; p. 2) defined "reflection is a form of mental processing – like a form of thinking – that we use to fulfil a purpose or to achieve some anticipated outcome. It is applied to relatively complicated or unstructured ideas for which there is not an obvious solution and is largely based on the further processing of knowledge and understanding and possibly emotions that we already possess." Boud (1985; p.3)**,** however, defined it as "a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to a new understanding and appreciation." Sandars (2009: p.685) reports that reflection "is a meta-cognitive process that occurs before, during and after situations with the purpose of developing greater understanding of both the self and the situation so that future encounters with the situation are informed from previous encounters."

According to Epp (2008), academia has combined the concept of reflection as valuable to critical thinking, insight and learning- it is considered to be a source of truth, information and self-regulation. Several researchers have reported that reflection serves as an avenue which allows students to move from engaging in just basic thinking to deeper critical inquiry (Pond et al., 1991; Callister, 1993; Cameron and Mitchell, 1993).

Reflective journal writing is a teaching approach whereby learners record their experiences and emotions in their own writing style for further reflection and analysis (Sándor, 2015). The reflective journal is utilized by both the educator and the learner in an educational environment to learn and assess the development and growth of the learner towards obtaining the skills of self-directed learning (Kok and Chabeli, 2002). This approach of teaching allows students to be creative in identifying personal, notable or evocative experiences to be recorded in diaries (Boykin and Schoenhofer, 1991). Hunter et al. (1995) stated that writing requires the author to articulate concepts and perceptions that would have been remote to the author without having experienced the process of writing. Reflective writing can also assist an individual to practice his or her responses to life events (Solem, 2011). Given the essential role that reflection has to play in learning, it is surprising that it does not occur spontaneously and has to be actively promoted (Chan and Uhlmann, 2015).

According to Chan (2015), reflection is an important part of learning. It is one of the four stages in Kolb's learning cycle (Kolb, 1984). According to Lachman and Pawlina (2006), reflection has been considered to be a core skill in professional ability, especially in the learning of professionalism in medical education. In classical cadaveric dissection, learners follow step-by-step instructions in dissection manuals (Chan, 2015). The gross anatomy laboratory is the best setting for small group interactions for faculty and students and between the students themselves. This setting provides an

invaluable opportunity for students to reflect on anatomical knowledge (Drake, 1998; Miller et al., 2002; McLachlan and Patten, 2006) to learn about the humanistic aspects of medicine (Rizzolo, 2002; Rizzolo and Stewart, 2006; Kostas et al., 2007). In this sense, dissection is proposed as a crucial experience in a student's passage towards becoming a physician (Heath, 1998).

According to Böckers (2015) human dissection is regarded as a firm teaching method in the discipline of anatomy and appeals for additional professional skills such as respect for patients, team-spirit, leadership and social responsibility, self-reflection and 'detached' concern which becomes important in learner doctors' later medical training (Pawlina et al., 2006; Swartz, 2006). Böckers (2015) further suggests that these objectives form part of the 'hidden curriculum' and that current anatomy teaching incorporates aspects of humanism and places professionalism and reflection in the anatomy laboratory as standard practice. Moreover, the dissection course is generally considered to be the first encounter with dead human bodies (Alt-Epping et al., 2014) and therefore offers a suitable opportunity for discussing issues such as death and dying. There are many studies that have reported on the emotional impact that dissection has had on students in managing deceased people (Finkelstein and Mathers, 1990; Dinsmore et al., 2001; Arráez-Aybar et al., 2008; Cahill and Ettarth, 2009), as expressed in the excerpts below:

> *"My name is Jane Doe and if you are reading this journal, it is because I am dead. When I reached the age of fifty, I decided to apply to medical school. Unlike you, there was no need to do my undergraduate degree in biology or chemistry…All that was required was a written, notarized form promising I never had AIDS or Hepatitis B and that it was my choice to become a cadaver… Since I am your very first patient and probably your most important teacher, I feel it necessary to tell you about the soul that inhabited this body and fill you in on what made it tick, what my passions were, and explain the many scars. And last and most importantly, it is my desire that through this journal you will become the best doctor and maybe a better person.*
>
> *Sincerely, Jane"*
>
> Excerpt extracted from The Cadaver's Journal (Carlsson, 2015; p. 1)

Wagoner and Romero-O'Connell (2009) report that students experience a variety of emotions when faced with the cadaver for the first time, including their own mortality. These sentiments are also expressed by other authors who report that a process of habituation begins after the initial encounter with the cadaver and student fear reduces significantly (Horne et al., 1990; Druce and Johnson, 1994; Dinsmore et al., 2001; Snelling et al., 2003; Hancock et al., 2004; Boeckers et al., 2010). The fear of dissecting the cadaver eventually leads to professional curiosity over time (McGarvey et al., 2001).

"On the first day of my gross anatomy course, I surprised myself by my reaction to meeting my cadaver and the beginning of the journey through the dissection process. This is a personal reflection that I produced following that experience: When I first unzipped the bag to reveal my cadaver, I was excited to meet my "first patient." As I removed the plastic to reveal his face, I froze in my tracks when I revealed the face of my Grandpa Jack. Silence. How could this be? Grandpa passed away years ago… As I regained my bearings, I realized that the cadaver I was staring in the eyes was not, in fact, my grandpa. Relieved by this understanding, I reflected on how quickly I had been shaken to my core by my first patient. Will this happen with all of my patients? Am I going to be an emotional wreck throughout my entire career? I hope not.

We began our dissection. The chest wall had already been removed, so our task was simple: remove the heart and lungs. Inside the chest, nothing looked real, this may as well have been a plastic model in the shape of a heart, ribs, and lungs. At last, our job was done! I stood holding a human heart in my left hand, and a human lung in my right hand. How cool is this? I never thought this would ever happen in my life. Oh wow! Look at all of the arteries wrapping their way around the heart! They look just like the textbooks described. How exciting!

We finished our work, and began to wrap our patient up to return him to storage. As we did, I caught a glimpse of his face. This time, he did not look like my grandpa, but he did look like a real person. I began to contemplate how "cool" it was to hold his heart in my hand. I began to imagine him years ago: exercising, leaving the saltshaker alone, eating his Cheerios, taking his blood pressure medication. Each of these in an attempt to protect the very same heart I was holding in my left hand. This isn't just a heart, this is someone's heart. This is the heart that fluttered when he had his first kiss, the same heart that he gave to his first love, the life-force that he desperately needed to function to keep him alive. And there I was oooh-ing and aaah-ing at how cool it was. No, this isn't cool, this is powerful."

(Excerpt extracted from Solem, 2011; pp. 26-27)

In addition, students experience a variety of emotions and physical symptoms when dissection is carried out for the first time. Although many investigations report positive attitudes such as excitement among students attending dissection (Dinsmore et al., 2001, Rajkumari et al., 2008), there are also studies that report on traumatic experiences (Mulu and Tegabu et al., 2012). Hancock et al (1998) reports that the process of cutting, dismembering, damaging and dis-assembling a dead body is outside the realm of everyday experience, more so to learners with little or no prior exposure to dead bodies. Finkelstein and Mathers (1990) report that students can experience stress in the form of post-traumatic stress disorder and somatic symptoms such as illness, disgust and sleeplessness. Böckers (2015) reports that at least 4-6 per cent of students experience nightmares, poor appetite and learning problems.

The idea of unrepressed writing during reflection was the core contributing idea to the writing of the manuscript entitled *Reflective Journals: Unmasking student perceptions of anatomical education.*

A significant component of this reflective practice by students measured the use of alternative, interactive and digital modes of learning as presented in the next section.

2.6 The Use of Technology in Medical Education

Technology is having a profound effect on education in the 21st century and anatomy educators are being challenged to integrate technological invention to assist students in their learning (Mackay et al., 2017). The nature of anatomical education has changed substantially over the last decade due to both a new generation of learners who learn differently from those of the past and the explosion of advances in anatomical imaging and programming. Medical students of today are products of the 'interactive generation' (Reidenberg and Laitman, 2002). Millennial-generation learners, also referred to as digital natives, are regarded as individuals whose development has been filled with technology (DiLullo, 2015). These learners have had extensive practice with digital exploration and communication and are claimed to be proficient with user friendly digital devices (Prensky, 2009; Margaryana et al., 2011).

Traxler (2013) describes mobile learning (mLearning) as learning utilizing mobile technologies such as mobile phones, smartphones, e-readers and tablets, and argues that these devices offer unmatched access to communication and information. Wilkinson and Barter (2016), propose that the increased affordability and functionality of mobile technology when associated with technologies previously used in education means they can sustain learning in novel ways within the classroom and at home. According to Nguyen et al. (2015), many of the studies into tablet education has been done in school-aged learners and the incorporation into higher education and training has been less uniform, mirroring the varying use of modern technology by higher-education academics. The rising occurrence of mobile tablet technology means medical software applications (apps) play a gradually significant role in medical education (Lewis et al., 2014). They often comprise supplementary content including clinical correlations and a range of media from instructional videos to interactive quiz functions. The strength of tablet technology lies in its ability to merge and present anatomical information to the learner in the most suitable manner for their learning style (Lewis et al., 2014).

m-Learning has been claimed to instruct the learner to identify how and where they learn best thus increasing the freedom of the learner (Wilkinson and Barter, 2016). Clarke and Svanaes (2014) state that personalisation of learning is emphasised as a significant factor in engagement and mobile technologies permit the student to learn in context and take ownership of their own learning. They also connect formal and informal learning environments and surpass environmental boundaries by virtue of

their portability. This implies that the technology can be utilized outside the classroom, probably facilitating what has been termed 'anytime, anywhere learning' or 'seamless learning' (Sha et al. 2012; Wong 2012; van't Hooft, 2013). Mobile technology has been claimed to sustain independent learning and the development of meta-cognitive skills or 'learning to learn' skills in young learners (Sha et al., 2012; Kearney et al., 2012; Wong, 2012). Wong (2012) argues that access to mobile technology permits learners to plan their own learning environments in terms of when, where and how they feel they can learn best and learning thus becomes progressively self-directed.

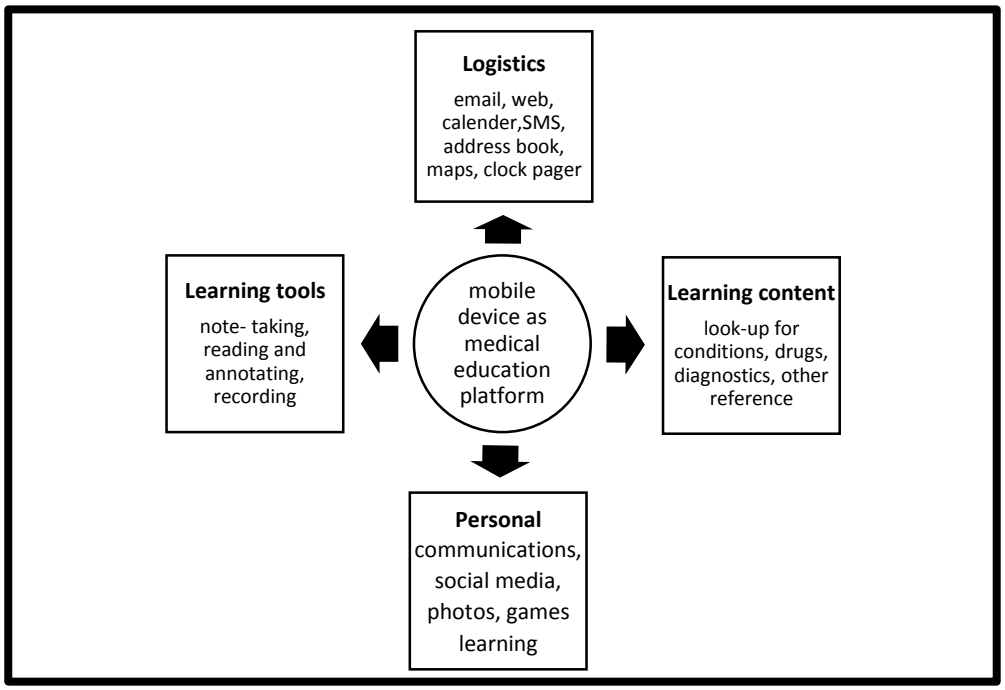

Figure 1: The four broad domains of mobile device use by medical learners
(Adapted from Ellaway, 2014)

Ellaway (2014) categorised mobile use by medical learners into four groups: (i) logistics (when learners use their devices for personal information management such as email and texting); (ii) personal (when learners use their devices for social and entertainment purposes such as social media and gaming; (iii) learning tools (when learners use their devices for learning tasks such as note taking; and (iv) learning content (when learners use their devices as a source of information such as checking drug interactions (Figure 1).

This preliminary literature review was the motivation to script an m-learning article – *Anytime, Anywhere': Tablet technology in Medical education.*

The teaching of anatomy has become increasingly challenging due to the advanced evolution of university teaching missions, a diverse student population group, medical curricula, together with a scarcity of empirically tested evidence- based teaching practices in the anatomical literature (Terrell,

2006). New educational frameworks have been developed and analysed to provide mechanisms to meet these pedagogical challenges as illustrated above. In the next section, the term "epistemology" is introduced with the idea of achieving greater understanding of the teaching and learning philosophies of human anatomy. What follows is a description of the different epistemological constructs that underpinned the manuscripts in this study – all of these are located with the broad domain of educational theory.

2.7 Epistemology of Teaching and Learning

Epistemology is defined as the individual lens, created through our worldview that we use to understand knowledge in the world (Egbert and Sanden, 2014). The pedagogic philosophies underpinning anatomy learning resonates with some general educational principles (Scott et al., 2014). According to Patel et al., (2009), it is improbable that any one pedagogical or learning theory will sufficiently account for all the skills and knowledge involved in anatomical instruction.

According to Miller et al. (2002), students have become more technology dependent, varied in motivation and are over-burdened with non-academic activities, time restraints and financial problems (Reidenberg and Laitman, 2002). Onion and Slade (1995) and Tarek (1999) report that anatomy educators are required to teach more students and more content as curricula change, with fewer resources as university budgets are cut resulting in reduced contact hours in anatomy. Marrone and Tarr (2005) state that understanding learning theories permit anatomy educators to be mindful of when and why different instructional methods may be used so that learnres are given the most appropriate learning support mechanisms they require to be successful.

According to Mayer (2010), medical education should be informed by a research-based theory of how people learn (i.e. the science of learning) and evidence-based principles for how to design effective instruction (i.e. the science of instruction). The praxis (teaching and learning) of anatomy is undertaken using a variety of methodologies, and all of these pedagogies benefit from students discussing and reflecting upon their learning activities.

The five articles begin with the researcher herself, an emergent anatomist, academic and researcher, then shifts to staff reflections moving into student reflections and resources. In its entirety, the collection of articles forces the attention away from more traditional notions of teaching and learning to conceptions that are broader, more critical and more nuanced. In the light of those shifting ideas, there is an attempt to interrogate our own tacit assumptions about the teaching, learning and research in anatomy education.

The nexus between theory and research is irrefutable as research relies on theory and theory development relies on research (Brown 1977). He states that this relationship between theory and research is a transaction where theory determines what data are to be gathered and results emanating from the research provide challenges to accepted theories. It is with this in mind that I present the teaching and learning theories that were used in the manuscripts – these are only summarily covered in the manuscripts.

2.7.1 Social Constructivism

The social constructivist theory was pioneered by Lev Vygotsky in 1978 and has become a major theory of learning in modern education (Phillips, 2006). It is an educational theory that describes a collaborative social process relating to the co-creation of knowledge amongst a community of learners. This educational theory also describes how a learner adapts to and explains events happening in the environment (McKinley, 2015).

According to Terrell (2006), the context in which learning occurs makes situations and events meaningful and relevant to the learner by affording opportunities to create new knowledge from genuine experience. The goal of social constructivist-based instruction is to help students build on previous knowledge and to create new knowledge in order to add to the richness of shared understanding within a united knowledge community (Saxe, 1991; Terrell, 2006). Marrone and Tarr (2005) state that learning occurs through iterative social processes, involving broad, shared, reflexive qualities. New knowledge is integrated and interpreted by combining prior knowledge against new information. Wertsch and Tulviste (1996) reported that social aspects are especially important to portray ideas both to themselves and to others. Cunningham and Duffy (1996) state that when individuals filter experiences, these experiences are in turn influenced by tools created through culture.

According to Shuell (1986), Derry (1996) and Marrone and Tarr (2005), students take responsibility for their own learning by framing questions, analysing information, and forming linkages between facts in order to predict, preserve, and sustain their ideas. Vygotsky (1978) introduced the 'zone of proximal development' in which a learner is capable of reaching a learning goal that is close to his or her existing structure but only through the help of a more experienced guide or tutor.The role of the teacher is to act as a facilitator and a co-participant in the learning process who adds value to the student-learning process by generating rich social interactions between students and course content, creating authentic learning experiences, and by forming a constructive and collaborative learning milieu (Terrell, 2006).

This theoretical framework underpins the manuscripts entitled *Bits, bytes and bones: An autoethnographic account of challenges in anatomy education: Perceptions emanating from a selected*

South African university; and *Reflective journals: unmasking student perceptions of anatomical education. Reflective Journals: Unmasking student perceptions of anatomical education.*

2.7.2 Community of Practice

Wenger (1998, p.45) suggests that "Communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavour." There are three crucial characteristics of a community of practice. The first component is the domain which is regarded as the identity of the community where there are shared interests (Van Noy et al., 2016). The second is the community which is comprised of participants who share mutual respect and trust. To become an official community member, an individual must work in the relevant domain and express buy-in or commitment. Members of the community value their joint competence and learn from each other (Van Noy et al., 2016). As such communities are informal and voluntary, both belonging and engaging which are essential. The third component is practice or working knowledge, including strategies and experience that can be shared with others (Angelle, 2008). Creating social contexts for learning by the development of communities of practice and an infrastructure for learners and experts (Lave and Wenger, 1991; Rogoff, 2003) is essential for effective learning and can be used to provide insights into the three manuscripts entitled: *Communities of practice: a new methodology in anatomical research and teaching, Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education* and *Reflective Journals: Unmasking student perceptions of anatomical education.* In this study the 'community of practice' refers to the interdisciplinary collaboration with co-authors well as national and international faculty-based at other higher education institutions in South Africa.

2.7.3 Situated Learning

Lave and Wenger (1991) proposed the theory of situated learning which hypothesises that 'everyday' unconscious learning occurs by reference to activity, context and the culture in which it takes place. In this model of learning, academic analysis requires social communication between the learner and either experts or other learners (Scott et al., 2014).Furthermore, collaborative activities also feature in models of 'situated learning' (Prawat and Floden, 1994).

McHarg and Kay (2008) engage with this theory by stating that 'situated learning' is based on two principles viz. firstly, that learning requires social interaction and that learners become involved in a 'community of practice'. Secondly, that knowledge requires to be offered in a reliable context. Learners transform themselves from novices to experts through observation, repetition and reflecting when they join the 'community of practice.' The learner does not learn in isolation by working alone which is a large part of the creation of experience, but with the valuable feedback of others in the 'community of

practice'. In their research, Lave and Wenger (1991) observed that new joiners to a community learned at the outside and as they became more capable they moved more to the centre. According to McHarg and Kay (2008), engagement in situated learning involves a social, cultural journey in which the learning of knowledge, skills and attitudes are entrenched which is pertinent to training in any profession or trade.

The critical characteristics of situated learning can be examined within a framework of the characteristics and responsibilities of three mutually-constitutive features of the learning process viz. the learner, the anatomy programme and implementation within the programme. Figure 2 has been adapted to consider all three interacting and overlapping elements. The advantages of situated learning for the learner include clear results of knowledge application which promotes articulation to enable tacit knowledge to be made explicit (Herrington and Oliver, 1995), learner-discovery of the appropriate conditions for relating knowledge and socialisation by community members which supports the collaborative construction of knowledge (Lave and Wenger, 1991). In order to realise the benefits of situated learning, learners should be given: chances to learn in real-life contexts and participate in authentic tasks; feel comfortable in communities of practice; have interactions with experienced community members who demonstrate expert performance; and engage in activities that reflect these opportunities and their participation (Lave and Wenger, 1991) (Figure 2).

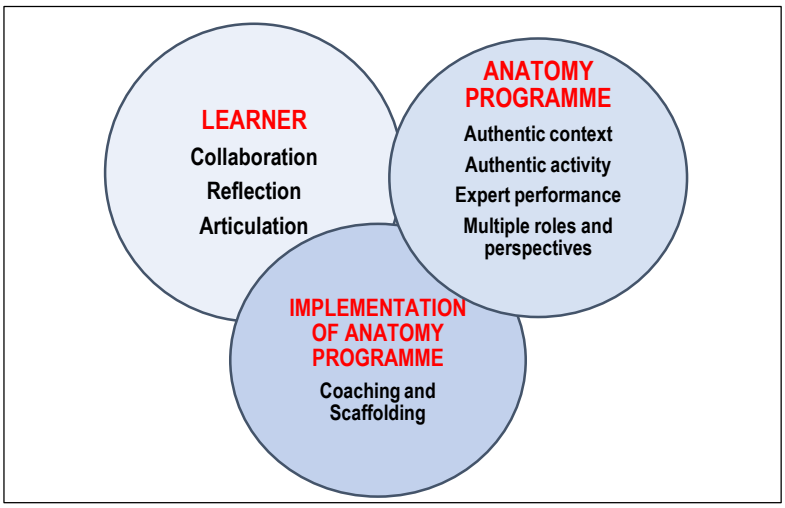

Figure 2: Constitutive elements of situated learning in anatomy education
(Adapted from Herrington and Oliver, 1995)

This theoretical framework underpins three manuscripts in this thesis: *Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: perceptions emanating from a selected South African University, Views of South African Academic Instructors to the Scholarship of*

Teaching and Learning in Anatomy Education and *Reflective Journals: unmasking student perceptions of anatomical education.*

2.7.4 Informal Learning

In this study context, I view informal learning that is "not tied to a program of study and occurs on an adhoc basis. Informal learning occurs when individuals want to improve themselves so that they can be productive in society and on the job and to develop themselves personally" (Ally, 2013; p5). Merriam et al. (2006) further states that informal learning is viewed as being impulsive, unstructured, and occurs in daily life across all settings and with no curriculum. Livingstone (2001) noted that informal learning occurs generally without awareness. Livinstone (2006) further suggested that informal learning should include all forms of deliberate and unplanned learning when learners are engaged either individually or collectively without direct reliance on a teacher or externally organized curriculum. This type of multi-faceted learning is voluntary, self-directed, and often facilitated by being within a social context (Bull et al., 2008); it provides an experiential base and motivation for further activity and subsequent learning. One such self-directed, informal learning model has been induced by the introduction of digital technology.

Technology has played a progressively important role in mediating learning. The widespread development and use of telecommunication and information technologies in recent decades has changed how learning occurs across the spectrum of formal learning environments (Van Noy et al., 2016). Technology has dramatically transformed the way learning occurs, especially since the advent of the Internet and the proliferation of smartphones. Mobile learning, which allows individuals to learn anywhere and at anytime, has played a major role in informal learning (Ally et al., 2008; Ally 2012; Clough et al., 2009) and to learn outside the classroom (Cavus and Uzunboylu, 2009; Jones et al. ,2013; Laietal.,2013; Terras and Ramsay, 2012).

This theoretical framework underpins the manuscript entitled' *Anytime, Anywhere'- Tablet technology in medical education*.

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INTERFACE…

Chapters 1 and 2 provided a background and literature review and an outline of educational theories related to this study. From this it is evident that there are numerous studies related to autoethnography in medicine, especially emotion-laden and highly sensitive topics such as illness, death and loss. Autoethnography utilises a powerful analytical process to create evocative narratives that seek to illuminate social worlds from a deeply personal perspective. It is a methodology that strives to connect personal experience to cultural process and understanding by using a back and forth gaze to focus outward on socio-cultural contexts while also looking inward at the self (Anderson, 2014). Autoethnography has also been utilised in studies documenting teaching practice in higher education. However, the use of autoethnographic studies linked to research and teaching within anatomy from a discipline-specific perspective is rare. In Chapter 3, I engage in this autoethnographic account using a subjective lens to gain and share new understandings of the interaction of my academic self with the higher education professional culture.

The aim of this chapter was to examine how a selected anatomy department engaged with education, research and delivery models through an autoethnographic approach and to examine the views and perceptions of colleagues regarding research in the domain of clinically-applied anatomy and how this has impacted on their teaching practice using collaborative work.

CONTRIBUTIONS TO THIS CHAPTER

This chapter is comprised of two papers that have been submitted for publication and are currently under review by the Journals.

Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: perceptions emanating from a selected South African University.

L Lazarus, R Sookrajh, K.S. Satyapal

Ethnography: Manuscript number: ETH-16-0097

Communities of practice: a new methodology in anatomical research and teaching

L Lazarus, R Sookrajh, KS Satyapal

Anatomical Sciences Education: Manuscript number: ASE-16-0159

CHAPTER 3

Finding the self in Biomedicine

SCIENTIFIC MANUSCRIPT 1

Title : Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating From a Selected South African University

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ABSTRACT

In this article, the first author describes the methodological approach of autoethnography and describes how this style enabled her to interrogate the current challenges and dilemmas underpinning the teaching and learning practices within her discipline.

The purpose of this paper is to examine how a selected anatomy department engages with education, research and delivery models through an autoethnographic approach. The selected department has undergone diverse restructurings in the last decade and the authors wish to explore, explain and understand these reforms using their reflective voices as academics. The study highlights challenges experienced by the first author such as the shortage of cadaveric material for teaching and research, the subsequent implementation of medical software applications, deficiencies in the curriculum and the teaching of anatomy by scientist anatomists. The use of autoethnography as an approach is an emerging transformative field of study within the Health Sciences at Higher Education institutions which is a move away from the traditional positivist models of research in the domain of anatomical education.

RESEARCH HIGHLIGHTS

- To highlight the use of autoethnography as an emerging transformative field of study within the Health Sciences at Higher Education institutions;
- To highlight educational challenges experienced by a specific discipline at a selected University;
- To highlight the shortage of cadaveric material for teaching and research, subsequent implementation of medical software applications, deficiencies in curriculum and teaching of anatomy by scientist anatomists; and
- To mobilise other academics into fuelling professional and personal inquiry to bring about a reinvention and renewal of their discipline.

Key words: autoethnography, anatomy teaching, reflection, medical education, human cadavers, gross anatomy

INTRODUCTION

A tale of two disciplines

"After completion of my Masters degree, I registered for the PhD in Anatomy. The University granted me ethical approval. I had a clinically applied topic which related to the vascular territories of the pancreas. I was to map out the different segments using resin casts of pancreatic vessels of fresh en-bloc specimens from the State mortuary in Durban, South Africa. The project also entailed further dissection of cadaveric specimens. The clinical component incorporated a review of Endoscopic Retrograde Cholangio-Pancreatographic images. In light of the lack of fresh tissue access and cadaveric donations, I was unable to proceed with this topic and several other topics which required similar research material. Having completed my Postgraduate Diploma in Higher Education, my co-supervisor (RS) introduced me to and stimulated my interest in a qualitative research methodology called autoethnography and I perceived it to be an avenue through which I could relate my collective experiences as an academic to spur on fellow colleagues to tell their stories as well to make sense of the culture in which we find ourselves.

It's the first day of the dissection hall orientation. I walk into the laboratory and it is impossible not to notice all of the sealed white body bags sitting on stainless steel tables. The lab is a huge white room that is extremely cold. This is due to the constant current of cool air blowing through the room to prevent smells from stagnation. There are large steel 'biohazard' buckets under each table that will be used to retain bits and pieces of human skin, fat, connective tissue, and other body parts that become separated from the cadaver over the course of the year. I am the lecturer delivering the introductory talk on rules and regulations of the cadaver lab, so students can prepare themselves adequately for the academic year. I scan the room and notice a mix of facial expressions – some excitement; others show apprehension. All students have donned their white coats in anticipation. After the formal overview of the lab, it's time to open up the bodies and show students how to dissect. There is a commotion at the back of the lab - one of the students has fainted and two are sobbing! Acclimatisation to the reality of death is a slow process and students will be monitored over the next few weeks to see how they are doing! Students are placed into groups around what would be 'their' cadaver for the year. They are reminded to elect rotating 'readers' who read out aloud the dissection procedure from a manual and 'dissectors' to dissect on either side of the body. As I reflect skin of the back, I use anatomical terminology to describe my actions. Anatomical terminology forms the basic language of medicine; the myriad of terms and facts related to the structure (anatomy) and function (physiology) of the human body, which a health practitioner simply must know if he or she is going to treat a sick patient. Students are shown how to hold the scalpel (and to put on and take off the blade without amputating a finger!), a scissors and forceps to develop their manual skills. As I proceed, I encourage students to communicate effectively with each other in the lab and demonstrate how to access further information. I inform them of the concept of human anatomical variations and that the dissecting lab is the best place to show these as students examine their own cadaver and compare it to fellow cadavers! The cadaver provides such a unique opportunity to appreciate the beauty and complexity of the human body!"

(Personal reflection by the first author)

If you are a teacher, have you ever imagined connecting with a student, who in your waking life you barely knew and actually taught them something? Have you sat back and thought about some of the challenges that may be driving your discipline into obscurity? In this autoethnographic account, I make a conscious effort to understand and make discernible my professional experience as an anatomy teacher. According to Pithouse et al. (2009), an exploration of this type of academic journey "illuminates educational challenges that have resonance beyond the self."

To Anatomise…

I was introduced to anatomy, a cornerstone of medical education (Turney, 2007) when I registered for a Bachelor of Medical Science degree. Many argue that it has survived the most demanding pedagogic test viz. that of time. Although having progressed over time, the common resolve of the scientific field over decades, and even centuries, is the enlightenment of the structure and morphology of the human body (Hirt and Shiozawa, 2013). I was intrigued by its origin and found out that historically, the word 'anatomy' is derived from the Greek word '*anatome*' which is a term constructed from 'ana,' meaning 'up' and 'tome,' meaning 'a cutting up' (O' Rahillay et al., 2004) and therefore an anatomist is defined as a 'scientist who studies anatomy' (*Concise Oxford English Dictionary*, 2010) and is regarded as "a dissector of dead bodies, a person skilled in anatomy" (Jones, 1997).

As I tracked its development as a field, anatomy was a symbolic and defining feature of the medical profession; however, developments in teaching and learning over the years have changed the role and identity of anatomy education (Dangerfield et al., 1996; Dyer and Thorndike 2000). In addition to these developments, anatomy teachers have been reviewing different approaches to anatomical teaching, including the role of computer aided learning (Kish et al., 2013), plastinated specimens (Riederer, 2014), dissection (Ellis, 2001; Aversi-Ferreira et al., 2010) including student views and concerns about the process of dissection (Nnodim, 1996; McGarvey et al., 2001). These reviews have been generated inter-alia as a result of the following reasons, viz. the lack of cadaveric material for teaching and research (Singh and Kharb, 2013), as has been the case at the institution where I am employed, a reduction in the number of hours allocated to anatomy teaching (Dangerfield et al., 2000, Drake et al., 2009), dwindling numbers of clinicians teaching anatomy or becoming career anatomists (Anand et al., 2004) and the fact that new anatomists are not trained properly (Pappa and Vaccarezza, 2013).

I begin by explaining the autoethnographic genre, because it is essential to provide a brief explanation of the researcher's life as it pertains to the research so that the reader may fully appreciate the context within which the researcher presents the data (Ellis and Bochner, 2000). I begin this paper by exploring a comparatively new research design in the anatomy education called auto-ethonography. As mentioned in the personal reflection above, it was my co-supervisor (RS) who mentioned the word "autoethnography" to me and in investigation. Coming from a social science background, this was not surprising because this design had gained momentum especially in reflective studies. In unpacking this innovative approach, it was the works of Polkinghorne (1997) who assisted me in grasping an understanding of a reality lived, experienced and constructed, and also made me recognise that I could establish a reason, for adopting a narrative approach. Polkinghorne (1997) claimed that, "The narrative provides a more epistemologically adequate discourse form for reporting and assessing research within the context of a post-positivistic understanding of knowledge generation."

Why Autoethnography?

I quickly learnt that autoethnography, which stems from the field of anthropology, is a developing qualitative research methodology in health professional education (Farrell et al., 2015). This methodology has been embraced by scholars in a variety of disciplines including sociology, education, communication, social work, nursing and medicine (Foster, 2013). Autoethnography as described by Ellis and Bochner (2000) is a genre of writing that exhibits several layers of consciousness connecting the personal to the cultural. They claimed that the distinctions between the cultural and the personal become blurred as the author changes the focus and moves back and forth between looking outward and inward.

In my readings on the subject of autoethnography, I have come to understand this as a qualitative approach to research and writing that seeks to describe and systematically analyse (graphy) personal experience (auto) in order to understand cultural experience (ethno) (Ellis, 2004; Holman Jones, 2005). According to Ellis et al., (2011), autoethnography helped people to make sense of themselves and others. Sociologist and author Denzin (1989) argues that autoethnographic research is embedded in the researcher's most important events of life, and it brings to the surface hard-to-solve provocative problems that can be interpreted through examination and analysis. Ellis and Bochner (2000) consider autoethnography to be autobiographical writing that interprets multiple levels of personal consciousness connected to cultural consciousness. Auto-ethnographers must then analyse these experiences by using methodological tools and research literature to account for these experiences (Ellis et al., 2011). Mendez (2013) further states that autoethnography has the potential to contribute to other people's lives by making them reflect on and empathise with the narrative presented. Autoethnography, in this way, becomes a valuable form of inquiry as readers may become aware of realities that they had not thought of before. Bochner and Ellis (2006) further state that autoethnography guides investigators in the process of figuring out what to do, how to live and how to make meaning of their struggles. According to Ellis (2004), through these narratives, people may be able to reflect on similar experiences and then be able to do something beneficial for themselves and for others. Autoethnographic research includes the rigors of both creative and reflective-analytical processes (Ellis and Bochner, 2000; Ellingson and Ellis, 2008).

In addition, with regard to implementing pedagogical research within a discipline, autoethnography permits the researcher to go beyond just the autobiography of teaching and learning efforts by combining autobiographical narrative details with a cultural analysis and interpretation. The result of this is the generation of new knowledge about the culture in which the individual is situated that can be meaningfully shared with others (Farrell et al., 2015).

Autoethnography and teacher education

Ellis et al., (2010) report on the production of thick descriptions of experience, both with oneself and with others. The use of reflexive inquiry as a methodological tool for writing about critical moments in the trajectory of one's career and how other people may have experienced similar critical moments provides impetus for this story. In this paper, we critically reflect on the first author's experiences as a lecturer and research-oriented anatomist who gives expression (via personal reflection) to the university challenges and dilemmas experienced within her discipline. The vehicle facilitating this investigation by reflection is a novel approach to understanding this journey viz. autoethnography. The first author has utilized memory work to allow her to make meaningful linkages between the experiences of the personal and the cultural as she recalled past episodes of her 'cultural situatedness', thus permitting her to make sense of her present self (Kuhn, 1995). As she is the research subject, interpretive analysis involves self-reflexive probing of her own expectations and conceptual frameworks, embedded in narratives of past events (Quicke, 2008). This methodology allows the first author to critically reflect on her multiple roles as an observer, professional educationalist and participant in interdisciplinary research that can be used to express and share real-life perspectives and experiences to have transferable implications for other academic identities. The other two authors of this study (RS and KSS) are also senior academic leaders affiliated to the selected University and are familiar with the challenges and constraints experienced by the first author; thus their place in this autoethnography is warranted as they provided useful discussions, guidance and reflections as co-authors. Ethical approval (BE386/15) for this study was granted by the University of KwaZulu Natal's Biomedical Research Ethics Committee.

THE THEMES

This paper focuses on my personal experiences, perceptions and understanding of the academic milieu I find myself in at the selected University. These themes derive from my personal journey on which I reflect on the bits, bytes and bones (as reflected in the title of this paper) affecting my discipline. The bits refer to qualification and pedagogy; the bytes makes reference to the use of computerised software and plastinates in anatomy teaching and the bones reflect on my shifting experiences from the former resources to cadaveric material.

Theme 1: Medical or non-medical: a conceptual mismatch

"When I began my teaching career as an anatomist, my Department fell under the auspices of the Faculty of Health Sciences. With the transformation agenda and University re-structuring, my Department was then incorporated into a College structure which fell under the School of Laboratory Medicine and Medical Sciences made up of eleven separate disciplines. There are no heads of each of these disciplines. Rather there are three main research focus areas (infectious diseases, molecular and cellular diseases, human body and function) where academic leaders have been appointed. Staff choose to slot into any one of the above areas and the academic leader becomes their line manager, irrespective of qualification in that field."

(Personal reflection by the first author)

In 2004, this incorporation into a College structure impacted on staff and disciplines in different ways. Two KwaZulu-Natal universities (the former Universities of Natal and Durban-Westville) were among the first batch of South African institutions to merge in 2004, in accordance with the government's higher educational restructuring plans that saw the number of higher educational institutions in South Africa reduced from 36 to 21 (http://www.ukzn.ac.za/about-ukzn/history). The University trajectory was to be a research-led institution. With the merger, came major changes in terms of University governance which resulted in a reconfiguration of Departments. Colleges comprising Schools came into existence. Departmental names were changed to reflect expanded research activities of faculty and to attract graduate students. There were amendments to the medical curriculum resulting in insidious changes in preclinical and clinical course requirements for graduate students. The knock-on effect of this was the interpretation of the preclinical courses being viewed as 'non-medical' with anatomy becoming almost abstracted from medicine. It is ironic that the University promotes research, notwithstanding the fact that there is a severe shortage of appropriate cadaveric material to conduct anatomical research!

Theme 2: Anatomy is taught by non-medically qualified teachers

"Why should you know anything? Have you ever examined a patient in your life?"

(Personal reflection by the first author)

The above sentiment was expressed vehemently to me by a clinical colleague at a meeting. Having read Bergman et al., (2011), she confirmed the assertion that there seems to be a worldwide trend for the subject of anatomy to be increasingly taught by staff with non-medical backgrounds. In my assessment of the situation at my University, I agree that the professional status of anatomists has been devalued (Habbal, 2009). Historically, there were two Anatomy Departments, one based at the former University of Natal (UN) (servicing medical students) and the other located at the former University of Durban-Westville (UDW) (servicing allied health science students). Staff (13 at UN; 7 at UDW) within

these respective departments comprised exclusively, medically qualified clinician anatomists and table doctors who held medical qualifications or equivalent Fellowships in various specialties. Over a period of time, post-merger (2004), there was an attrition of these experienced teaching clinician anatomists as they either retired at age 60 or have died. The recruitment of such medically qualified anatomy faculty has languished to such an extent that no such staff have been employed in the last ten years. Currently, there are only two existing clinician anatomists within the Department. Positions within the Department have been granted to generalist scientists with qualifications at either Masters or PhD level. These individuals have not been exclusively trained in teaching within the anatomical discipline. Additionally, compounding the scenario is the tendency to offer unattractive non-medical salaries to those with clinical qualifications (Ellis, 1994); thus there is a failure to recruit clinician anatomists for core teaching. It is lamentable that such a situation prevails as we should never under-estimate our clinical colleagues as they enjoy teaching students and they are often the strongest supporters of anatomy education and educators (Reidenberg and Laitman, 2002). Clinician anatomists bring the anatomical sciences to life. On the other hand, new faculty members (who are generalist scientists) are hired for their research strengths particularly in cellular and molecular biology. At the University of KwaZulu Natal, there is what I perceive to be a dangerous assumption by Senior Executives that embrace the philosophy that 'any general scientist can teach anatomy.' I know that in my experience, this is clearly not the case. According to Habbal (2009), most scientist anatomists cannot bridge the divide between basic science and clinical application and the quality of anatomy teaching has fallen below the optimum level (Turney, 2007; Rizzolo and Drake, 2008). Additionally, given their non-medical training background and promotion expectations, it seems likely that such scientist anatomists will give more importance to research than to teaching (Willan and Humpherson, 1999). The swing of the pendulum from one extreme to the other does not create for a healthy educational stance. Despite these challenges, I am of the firm belief that there is a place for scientist anatomists in the teaching of the discipline. What matters most is the quality of teaching! I have been trained by clinician anatomists and have learnt over the years what clinically relevant gross anatomy is required for a medical curriculum. My knowledge of appropriate anatomical expertise and educational methods is what is required to make me an all-encompassing anatomist!

Theme 3: Deficiencies in the curriculum

"I search for lectures related to the anatomy of the head and neck. The lecture on the anatomy of the mouth and larynx fell into the Respiratory System Theme. There are no lectures on the muscles of facial expression or mastication! How odd? Are medical students meant to have gaps in their knowledge?"

(Personal reflection by the first author)

At the University of KwaZulu Natal, the incorporation of anatomy into the medical curriculum has had a turbulent history. Over the last two decades, there have been periods where the programme incorporated a prosection-based anatomy course only. Most of the anatomy content is taught predominantly within the second and third year of a six year medical programme with limited exposure to the subject in the subsequent clinical training years. Currently, the course entails limited dissection of anatomical systems within themes. The current offering does not incorporate a theme dedicated to Head and Neck Anatomy. An example of this is as follows: a lecture on the anatomy of the mouth or larynx is covered under the Theme entitled 'Respiratory System.' The design of the curriculum is handled by a team of medical and non-medically trained scientists which forms the core expert group which generates guidelines on the content of the curriculum. Anecdotal reports from the faculty at the University illustrate the lack of adequate anatomical knowledge of senior medical students, interns and registrars. This is an opinion shared by other international publications highlighting the problem of decreased anatomy knowledge of today's medical students for safe medical practice (Fasel et al., 2005; Waterston and Stewart, 2005). However, some clinicians offer a counter-argument as they are of the view that 'there is too much anatomy in the undergraduate curriculum' and that it is unnecessary for students to have such a detailed knowledge of anatomy which results in a factually overloaded anatomy curriculum. They are of the view that clinically applied anatomy should be taught.

Theme 4: Medical software applications, prosections and plastinated specimens

"I stand in front of the lecture hall. A young man with a video camera films my delivery of a lecture on the Anatomy of the Liver. 'Just pretend I am not here,' he says. Easier said than done!"

(Personal reflection by the first author)

To palliate the paucity of cadaveric material for teaching and research, newer teaching modalities and modern technologies are being integrated into the anatomy curriculum to encourage interest and retention of anatomical knowledge and its clinical relevance. In 2013, I was helplessly drawn into a programme at my University where anatomical pedagogy was revised to incorporate the Visual Learning Project which was adopted by the College of Health Sciences in December 2013. In this project, academics were meant to record their lectures so that students could access them anytime, anywhere. It is a daunting experience being filmed on camera where students hang onto your every word! Students were issued with multimedia tablets to engage with live readily expandable and understandable streamed lectures. Practicals entailed the use of prosections, plastinated specimens, plastic models and multi-media learning packages to aid retention of knowledge. I surmised that as mobile technology develops, it creates new opportunities for enhancing the learning experience of students at all levels of education (Mang and Wardley, 2012). Goral (2011) provided a comprehensive

account of the main advantages of using tablet technology viz. using software applications to enhance creativity, critical thinking and encouraging greater interaction among students and faculty. The rising popularity of mobile tablet technology means medical software applications ('apps') play an increasingly important role in medical education. The strength of tablet technology lies in its ability to merge and present anatomical information to the user in the most appropriate manner for their learning style (Lewis et al., 2014). However, Fischman and Keller (2011) reported that the trials of iPads at Stanford University and at the University of Notre Dame were not successful as many students were uncomfortable with the technology and abandoned its use within a few weeks in favour of more traditional technologies such as laptops.

In my discussions with students, interesting anecdotal student feedback was received with regard to this project. The following comments are noted below:

- Enthusiasm about the idea of having visual material to supplement learning;
- Students made attempts to find these videos online; however these attempts were unsuccessful;
- Some felt it was a waste of time as they felt it was extra material to look at and they didn't have time to go back and review it;
- Some students indicated that they would prefer not to attend the lecture since the material was online anyway; and
- Some indicated that they would only go back and look at the material if it was for marks.

Theme 5: Cadaveric procurement challenges

"Whole brain specimens laid out on steel trays. It is time for me to set up a spotter exam (an assessment where specific structures are pinned on cadaveric material and students are asked subsequent questions related to that structure) for our Dental Therapy students. I would like to test them on identification of the trigeminal nerve. As I look at the specimens, it is difficult to choose one as all are tattered. There are pin marks on the nerves as they have been used so many times. I think to myself that we are in dire need of a fresh bank of material so that my students can have appropriate teaching resources. But I know deep down that this is just a far-fetched dream…"

(Personal reflection by the first author)

Anatomy teaching at the University of KwaZulu Natal has traditionally been based on the use of human cadaveric specimens, either taking the whole body specimens for complete dissection or as prosected specimens. The debate on teaching via the conventional pedagogy of cadaveric dissection versus the computer and more innovative modalities has raged on for the last decade (Guttman et al., 2004; Winklemann, 2007). Those who advocate retaining this traditional learning (the so called 'traditionalists') exercise, cite the value of the cadaver experience (Yeager, 1996; Johnson, 2002). Those who see the practice as redundant defend their position by pointing to recent technological

advancements (the so called 'modernists') (Granger, 2004; McLachlan et al., 2004; Pawlina and Lachman, 2004).

In South Africa and especially in the province of KwaZulu-Natal, there is no large body donor programme, with unclaimed bodies being the main source for anatomical dissection. The University has relied heavily on the State Mortuary as a source of unclaimed bodies to sustain our undergraduate teaching and postgraduate research programmes. In the South African context, much has changed post freedom (1994) with the replacement of the *Human Tissue Act No 65 of 1983* with Chapter 8 of the *National Health Act 61 of 2003*, which was updated in November 2013. A peculiar provincial interpretation of this Act has resulted in the virtual ceasing of access to unclaimed cadavers. In 2006, several of the state mortuaries (who were previously administered by the state police) became governed by provincial departments of health, resulting in a significant reduction in the available cadaveric organs and tissue for clinical and research use. This was occasioned in part by perceptions (not necessarily correct) regarding the constitutional and ethical limitations on the use of human tissue from deceased persons, and in part because in some provinces (viz. KwaZulu Natal) it appears that the police no longer see it as their duty to assist in taking 'reasonable steps' to locate persons who may be able to consent to unclaimed bodies in state mortuaries being used for tissue donation (McQuoid-Mason, 2011). Media reports quote a colleague of mine as saying that "a large part of the problem at these State Mortuaries was that mortuary technicians were allowed to dictate terms related inter-alia to ethical issues regarding donation of the bodies to tertiary institutions". As a result, Anatomy Departments within the province had to rely solely on donated cadaveric material to sustain the undergraduate teaching programmes. Due to the dwindling numbers of donors, the Department had to seek out other avenues of sustaining the teaching programme by 'importing' cadaveric material across trans-provincial borders from other tertiary institutions in South Africa.

I have personally experienced that the shortage of material to sustain teaching and research at my institution has had serious negative knock-on effects for student and staff capacitation. This dilemma is not unique to South Africa (Mothibi, 2015). According to the Anatomical Society of Southern Africa, this shortage is caused by the increasing number of medical students countrywide with a concomitant decrease in the donation of bodies for anatomy teaching (Mothibi, 2015). Professor Maryna Steyn, President of the Anatomical Society states that

"*It is extremely important for any medical or medical-related student to learn the anatomy first hand from a human body, knowledge can never be replaced by computer program or by handbooks. This is leading to huge problems for all of us at medical schools as we do not have enough cadavers to do the training that we need to do; therefore it's so important for us to really request and ask for people to consider donating their bodies to anatomy departments for further training and education*."

(Mothibi, 2015).

CONCLUSION AND RECOMMENDATIONS

Self-reflection for educators has been advocated in the broader education field and we are of the view that it can be an important methodology in anatomical educational research to highlight both challenges and milestones within the discipline. Educators who engage in autoethnography may derive substantial personal value from regular reflection required to perform this type of research.

Basic science and clinical faculty are baffled as to the future of anatomy teaching. South Africa, like other countries around the world, will have to earnestly consider how they will sustain adequate anatomy education. We believe that anatomists, clinicians and medical educators in association with national and international societies need to work in tandem for the creation of guidelines on how to overcome these serious challenges in a discipline that forms the bedrock of medical education. Since the structure of universities is changing from discipline-centred departments to interdisciplinary programmes, the introduction of generalist staff have created problems for graduates who still must be instructed in the anatomical disciplines (Rizzolo and Drake, 2008). One approach to solving this challenge would be the implementation of common guidelines for training programmes for graduates who wish to pursue careers as scientist anatomists.

This exploration of my academic journey attempts to illuminate "educational challenges that have resonance beyond the self" (Pithouse et al., 2009). The features which characterise autoethnography permeate this reconstruction of my academic self (Ellis et al., 2010). Using reflexive inquiry, autoethnography has been a valuable methodological tool in examining the complex, diverse and sometimes messy world within my discipline and the Institution and has enabled me to perceive and interpret the meaning of critical events in my career. Through this personal narrative, the authors "invite readers to enter their world and use what they learn there to reflect on, understand and cope with their own lives" (Ellis, 2004). This work highlights challenges experienced by a specific discipline and aims to mobilise other academics into fuelling professional and personal inquiry to bring about a reinvention and renewal of their discipline.

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SCIENTIFIC MANUSCRIPT 2

Title : **Communities of practice: a new methodology in anatomical research and teaching**

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ABSTRACT

Autoethnography is a qualitative approach to research that seeks to describe and systematically analyse personal experience to understand cultural practice. Collaborative autoethnography is a research method where researchers work in tandem to collect autobiographical materials, analyse and interpret their data collectively to gain a meaningful understanding of sociocultural phenomena reflected in this data. When using collaborative autoethnography, the researcher is both the instrument and data source. This type of research permits for deeper learning about the self, others and fosters collaboration among researchers. The aim of this paper was to examine the views and perceptions of colleagues regarding research in the domain of clinically applied anatomy and how this has impacted on their teaching practices using our collaborative work as a point of reference. Participants were identified as those individuals who were involved as co-authors (n=10) on co-written papers. Semi-structured one-on-one interviews were conducted with research team members. Interviews were audiotaped and transcribed verbatim. This methodology allowed the first author (LL) to critically reflect on her role as a basic scientist in this research team. Themes that emerged from the data were (i) Collaboration as heightened awareness, (ii) Impact of human anatomical variations, (iii) Association with medical and non-medical collaborators and (iv) Bridges to clinical practice. In this study, collaborative autoethnography is being used to investigate the potential significance of a deeper understanding of research partnerships in anatomy studies. Voice, experience and theory become mutually entwined in an investigation which embodies the essence of scientist-clinician partnerships to promote and sustain interdisciplinary research.

Key words: collaboration, autoethnography, clinicians, anatomists, interdisciplinary research, anatomical education research, medical education.

INTRODUCTION

The accidental anatomist

"I began my profession in anatomy almost on a gamble, coming to University to pursue grandiose ideas of pursuing a career as a physical therapist. A chance application to the Anatomy Department led to graduation a few years later and a position as a Research Assistant within the Department. The Anatomy Department at the former University of Durban-Westville (this University merged with the former University of Natal to become the University of KwaZulu Natal post-apartheid according to the South African Government's transformation agenda for higher education) was a gathering place for several distinguished anatomists, who were all clinically qualified. I felt out of place and overwhelmed that I just wouldn't be able to know enough anatomy as my colleagues! Although it is a funny story how I registered for my Masters degree and was eventually appointed as a lecturer, it is not relevant here! Although I was a basic scientist, my colleagues (and former teachers) accepted me into the group. By that time, I had learnt enough to know that no research meant no promotion. My promoter, who was also the Head of the Department, introduced me to some of his clinical colleagues and this is how our collaborative relationship was born…It is interesting to note that none of them mentioned my non-clinical background!"

(Personal reflection by the first author).

Autoethnography as a practice, seeks to connect personal experience to cultural process and understanding and argues that as a researcher and participant, I am as close as I can get to the social process, creating potential for greater depth and appreciation. Interaction among scientists is regarded as the essence of scientific practice (Melin and Persson, 1996). The emphasis of collaboration is to work with others. Research collaboration is defined as "the working together of researchers to achieve the common goal of producing new scientific knowledge" (Katz and Martin, 1997). Melin and Persson (1996) report that collaboration is considered to be an intense form of interaction, that allows for effective communication as well as the sharing of competence and other resources. Katsouyanni (2008) cited collaborative research as being "conceptualized as a research effort done by research groups from different disciplines (interdisciplinary research)" which may lead to co-authorships of scientific publications.

Research collaboration as professional praxis

Autoethnography, which is a branch of anthropology, is an emerging qualitative research methodology in health professional education (Farrell et al., 2015). It is a practice which allows the investigator to move beyond the mere autobiography of teaching, learning and research by combining autobiographical narrative details with a cultural analysis and interpretation (Farrell et al., 2015). This inter-relationship between the self and the culture falls within the interpretivist research paradigm (Bunniss and Kelly, 2010) which emphasises a reality that is subjective and continually shifting. It allows for an exploration

of knowledge as a personal entity. Investigators utilise 'reflective practice involving both personal reflection and social critique (Finlay, 2008) to describe their own experiences and inter-relationships with learners or colleagues (Farrell et al., 2015).

Collaborative autoethnography is defined as a "qualitative research method in which researchers work in community to collect their autobiographical materials and to analyze and interpret their data collectively to gain a meaningful understanding of sociocultural phenomena reflected in their autobiographical data" (Chang et al., 2013). The benefits of collaborative autoethnography includes power sharing among researcher participants; efficiency and enrichment of the research process, a deeper learning about the self and community building (Chang et al., 2013). Researchers may benefit from the insight of others from disciplines other than their own when they collaborate on research projects. Interdisciplinary collaboration is defined as an "interpersonal process leading to attainment of specific goals that are not achievable by one team member alone." (Gabrielova and Veleminsky, 2014)

Universities worldwide have "changed from a previously relatively autonomous academic organization to one based on business ideals" (Ek, 2013). Thus, university staff are pressured into generating income for their Institutions and also into adapting their work to meet the requirements of funders (Porter, 1997). At the University of KwaZulu Natal, academic members of staff are expected to meet their key performance areas annually in the form of teaching, research output, postgraduate supervision as well as their own personal credentialing. Coupled with this are discipline-specific challenges such as the shortage of cadavers that are used for studies of medical science (Mothibi, 2015). According to the Anatomical Society of Southern Africa the shortage is caused by the increasing number of medical students across the country and the decrease in the donation of bodies (Mothibi, 2015). This dearth of cadaveric specimens has resulted in anatomy department staff fostering collaborative research efforts with clinicians in specialist practices to meet University requirements as academics.

These collaborators are termed nodal informers within the context of this paper. The term 'nodal' has been utilized to describe critical events or key incidents in the first author's life around which pivotal decisions revolved (Sikes et al., 1985). According to Strauss and Corbin (1994) these critical incidents represent a turning point in the "onward movement of personal careers" and at this point the individual realises that "I am not the same as I was, as I used to be." The nodal academic moments encountered in the first author's life pertains to the interdisciplinary collaboration that she has enjoyed with colleagues. Three nodal areas of investigation from co-authored published manuscripts have been categorised into three regions viz. cardiovascular, neural and osteo-anatomy (These will be elaborated upon in the Materials and Methods section below).

Therefore, the aim of this paper was to examine, autoethnographically, the views and perceptions of these nodal informers (working together as co-authors on collaborative projects) regarding research in

the domain of clinically applied anatomy (based on the nodal areas identified above) and how this has impacted on our teaching practices using our own work.

MATERIALS AND METHOD

Design

A qualitative research approach was utilised in this study as it allowed for expression of meanings, experiences, views, and attitudes of participants (Soever et al., 2014) regarding their views on the feasibility of collaborative on-going research participation. Qualitative research is interpretive, with its goal being to understand the meanings of social events in their natural settings (Denzin and Lincoln, 1994).

Sampling

A small sample (n=10) was chosen for this qualitative inquiry as this enabled us to understand the central phenomena of the study. Participants in this study were identified as those individuals who were involved as co-authors in published manuscripts (Table 1). These participants are referred to as nodal informers and represent a cohort of general surgeons, orthopaedic surgeons, cardiothoracic surgeons, general physicians and gross anatomists who were purposively sampled for this investigation. Participants were initially informed via email that such an investigation was being conducted and were invited to take part in an interview. Telephone calls were made to set up these interviews with the principal investigator of the research team (LL). Ethical clearance was obtained from UKZN's Biomedical Research Ethics Committee (BE386/15).

Procedure

Semi-structured face-to-face interviews were conducted with nodal informers (x8 participants). For those nodal informers that live abroad (x2 participants), the interview schedule was sent to them in an open-ended questionnaire format and they were requested to fill these out electronically. Informed written consent was obtained from all participants prior to each interview. All other interviews (x8) were conducted in person, based on the interview schedule (Table 2). The length of interviews ranged between 30-45 minutes. The interviews were audiotaped and transcribed verbatim. Data collection continued until all participants who consented to be involved in the study were interviewed.

Data analysis

Each transcript was analyzed by the researcher (LL) using analytical induction (Katz, 2001) for emergent concepts related to the research objectives. Participants were questioned on the benefit or non-

benefit of cross discipline research, research strengths and weaknesses and the impact of research on teaching (Table 2). We did this to allow for patterns, themes and categories of analysis to develop from the data (Patton, 2000). According to Ellis (2004), thematic analysis can be used to analyse the stories which is then considered to be data and treated as such. Ellis (2004) states that the:

"The author might or might not decide to add another layer of analysis by stepping back from the text and theorizing about the story from a sociological, communicational, or other disciplinary perspective … 'Thematic analysis' refers to treating stories as data and using analysis to arrive at themes that illuminate the content and hold within or across stories."

A colour coding system was used to organize the data into categories by clustering ideas that pertained to the same concept. In order to validate the data, two other academic staff who were not involved in anatomy research coded the data, thereby ensuring triangulation. According to Denzin and Lincoln (2011), triangulation is a procedure that reduces the likelihood of data being misconstrued and involves the combination of two or more investigators within one study to increase the credibility of findings and limits prejudice. In addition, each interview transcript was analyzed prior to the next interview in an "analyze as you go" approach that allowed for potential modifications of the interview guide, thereby contributing to study rigour. Based on this approach, the questions remained unmodified. The first author then met with the independent reviewers to determine categories from which broad themes were identified and extracted.

RESULTS

Demographic data

The sample of this study consisted of a total of 10 participants of whom 6 were male and 4 were female. The highest qualification of the respondents were as follows: Senior Doctorate in Medicine (x1), MBChB + Specialist Clinical Degree + PhD (x1), MBChB+ Specialist Clinical Degree (x3), MBChB (x1), PhD (x3) and M. Medical Science (x1). Nodal informers belonged to the following disciplines: Surgery (x4), General Medicine (x1) and Anatomy (x5) (Table 3). The number of years of experience in their respective fields ranged between 7-40 years.

Emergent themes

Four main themes emerged from the data: (i) Collaboration as heightened awareness (ii) Impact of human anatomical variations, (iii) Association with medical and non-medical collaborators and (iv) Bridges to clinical practice.

Theme 1: Collaboration as heightened awareness

Participants were motivated to be involved in the research team and to contribute actively to promote discussion regarding areas of anatomical contention. Being involved as a collaborator afforded opportunities to revolutionise surgical technique based on the outcomes of basic anatomical research. Participants were also motivated to produce publications and this heightened appreciation of clinically applied anatomy in their respective disciplines. Ultimately, participants were of the view that this type of research collaboration had broadened their perspectives of clinical practice and its import. Participants also expressed a sense of gratitude for inter-disciplinary research.

"I found collaborative research work beneficial in enhancing the scope of thought and discussion, as well as affording the opportunity to innovate aspects of surgical techniques." (Participant 1)

"Research collaboration has many benefits such as the publication of articles with higher impact; more creativity in research and less work without compromising standards by the collaborators; efficient and effective learning and higher productivity. It has broadened my horizon with respect to patients' care" (Participant 5)

"I consider research collaboration to be an eye-opening learning experience as it forces you to step out of your comfort zone and apply your mind way beyond that circumference of your circle. Although each individual is recognised for their knowledge, interest and expertise in their own area within the Discipline, once they exchange ideas and collaborate with another Discipline, he or she is suddenly faced with a large spectrum of possibilities regarding his or her project. It's just a matter of application and seeing things from the perspective of similarly-related Disciplines" (Participant 3)

"Our work in surgery is intimately involved with the anatomy of the body. So having an understanding of the anatomy is a pre-requisite to be able to do corrective surgery. So unquestionably, a knowledge of anatomy is (most) fundamental in any surgeon's practice" (Participant 9)

Theme II: Impact of human anatomical variations

Participants expressed an appreciation of human anatomical variations that may have important influences on clinical examination, investigation and patient management, including operative surgery. They also indicated that when these variations are encountered, these are shared either formally or informally with colleagues to gain a broader understanding of the anatomical base of the area in question so that clinical situations can be managed competently.

"Heightened my awareness to anatomical variations and its application to surgical interventions. It has also ensured a heightened appreciation for the understanding of clinically applied anatomy which has resulted in a better surgical technique and better patient clinical outcomes." (Participant 4)

"When these variations are encountered they are shared amongst my research colleagues both formally in the form of presentations that are presented at conferences and informally to clarify/confirm the findings and discuss the implications thereof." (Participant 2)

"I have been able to show that anatomical knowledge is an important medical science subject which is fundamental to clinical practice. The knowledge of its variation is a necessity."(Participant 5)

Theme III: Association with medical and non-medical collaborators

Participants recognised that non-medically qualified colleagues contributed to the translational application of their research to problems in clinical medicine. Some of the participants indicated that they found non-medically qualified colleagues to be much more enthusiastic and committed to the research endeavour; however, others were of the view that such colleagues required to be capacitated. There was a common consensus that the varied professional complement of individuals in the research team was essential for producing research outcomes that were broad and deep.

"I have been involved in collaborating with clinical colleagues as well as colleagues that are not medically qualified. I have found, in general, that non- medical collaborators are much more enthusiastic in the research process. Non- medical collaborators also extend the scope of the research project" (Participant 1)

"With regard to non-clinical colleagues, there was an absolute need to train and equip them in order that they fully understood the clinical import of a concept which had a clear anatomical base. With regard to my clinical colleagues, it served as a useful sounding base, problem-solving exercise, a heightened awareness of anatomical variations and surgical pitfalls and a healthy understanding of the critical role that a 'basic' science called anatomy plays in the applied medical sense."(Participant 4)

"I found that people in the clinical field are very committed but have very little time and they are not predisposed to doing a lot of hard work. But collaborating with people outside my discipline, particularly the Department of Anatomy, I found that a lot of work gets done which would otherwise not really get done by clinical people" (Participant 9)

Theme IV: Bridges to clinical practice

As noted earlier, the research team was composed of a variety of individuals who collectively thought that collaborative research had benefitted their teaching practices, especially at postgraduate level. Participants proposed key characteristics of how collaborative research can be utilised in knowledge transfer.

"Providing a sound basis for surgical techniques – particularly in the context of postgrad teaching and transfer of technical skills" (Participant 1)

"I have always believed that if you taught health care professionals on the benefit of clinical applicability and then go to the basic science, you immediately have a captive audience that is not only stimulated and more interested to learn rather than a series of boring lectures and anatomical and clinical facts. In all my interactions I use clinical application and anatomical variations as a routine and I encourage my younger colleagues to do the same" (Participant 4)

"Stimulate their (student) interest in such research and making them understand what impact such research can have on anatomical knowledge and clinical practice." (Participant 5)

DISCUSSION

A theatrical experience

"The theatre is cold. Machines beep and staff look like aliens in their green scrubs. The patient lay supine on the table with arms extended away from her body. All that is visible are three puncture sites where instruments penetrate the woman's body. The screen is filled with images of a trocar manoeuvring its way towards what looks like a corded structure. It looks different to the anatomy that I am familiar with. There is a lot of fluid and the surgeon steers and explains his way to a blob which he identifies as the second thoracic ganglion. He directs the instrument lateral[ly] to the corded structure and finds a connection between successive nerves. "It's the nerve of Kuntz", he pleasantly acknowledged. The surgeon redirects his instrument to the blob-like structure, cauterizes above and below and finally removes the ganglion."

(Personal reflection of the first author emanating from publication of the paper entitled "A thoracoscopic view of the nerve of Kuntz" - Table 1)

"I recall an infant boy lying limply on the table and watched with trepidation as the cardiothoracic surgeon began his work. As he worked he pointed out the most important anatomical structures and explained how the corrective surgery would assist the infant post-operatively. As I watched with awe, I began to think about my role in this team. Although it seemed insignificant at the time, I did have a role to play: a child born with a double aortic arch is indeed an unusual variation!"

(Personal reflection of the first author emanating from publication of the paper entitled "Double aortic arch: an unusual congenital variation."- Table 1)

Using the qualitative research methodology of autoethnography, the above two examples have allowed me to place myself at the heart of this research process. Our research has demonstrated that interdisciplinary collaboration among diverse team members with common interests and goals have contributed to a richer learning experience and led to outcomes with clinical import. Four major themes were identified in this study viz. (i) value of research collaboration, (ii) impact of human anatomical variations, (iii) association with medical and non-medical collaborators and (iv) teaching practice emanating from collaborative research. Our study concurs with Katz and Martin (1997) in that there was a sharing and transfer of knowledge, skills and techniques between the researchers and participants. This study also elicited responses such as the generation of new insights and perspectives, that individuals working on their own, would not have grasped (or grasped as quickly) concurring with that which was reported by Hoch (1987). An underlying benefit of collaborative partnerships is that they provide intellectual companionship from the lonely occupation of research. Our study also reiterates the sentiments expressed by Katz and Martin (1997) that collaborative research efforts result in diffusion of findings through formal routes such as publication. Furthermore, research requires not only scientific and technical expertise, but also the social skills such as trust and respect for each other which is required to work as part of a team. This is reiterated in our study by participants referring to the enthusiasm of basic scientists. Participants were also of the view that association with basic scientists proved beneficial as they had more time to devote to projects when compared to their clinical counterparts. Phitayakorn and Lachman (2015) report that there are benefits to anatomists and surgeons working together that will ultimately improve patient care even though it is via a more indirect downstream effect. They further state that surgeons and anatomists could share a mutually advantageous relationship by greatly enhancing each other's academic productivity. Similar thoughts were expressed by participants in this study.

The concept of human anatomical variation and its clinical import is of considerable significance for medical practitioners and researchers (Strkalj et al., 2011). According to Braun et al., (2007), "improved medical training" on human variation "can sharpen diagnostic skills." Participants in this study consistently mentioned that collaboration had in fact improved their awareness of human anatomical variations.

Spencer and colleagues (2008) report on the need for greater collaboration among clinical and basic science departments to provide physicians and scientists with opportunities to exchange ideas, to understand and value each other's perspectives, to teach each other and jointly to teach future physicians.

According to Dyer and Thorndike (2000) and McLachlan and Patten (2006), anatomy is a descriptive basic medical science that is no longer considered to be a research-led discipline. Yammine (2014) states that the majority of 'anatomical' published papers in clinical journals are case reports of an

anomaly or variation, cadaveric or radiological prevalence studies or descriptions of new surgical approaches and recommended the concept of evidence-based anatomy. Despite this concept promoting the idea of trans-disciplinary research, it still requires the collaboration between anatomists and clinicians of various backgrounds.

This study utilises the theory of situated learning to make sense of the data. The theory of situated learning, proposed by Lave and Wenger (1991), hypothesises that 'everyday' unconscious learning occurs by reference to activity, context and the culture in which it takes place. This theory encapsulates the philosophy that learning requires social interaction and that learners become involved in a 'community of practice.' It is a socialising, cultural journey in which the learning of knowledge, skills and attitudes are embedded, and it is pertinent to training in any profession or trade (Lave and Wenger, 1991). In this study the 'community of practice' refers to the interdisciplinary collaboration with co-authors (the so called nodal informers). Cultivating an academic climate where interdependence is seen as resourceful is necessary and helpful for our growth as new and older academics. Through collective participation novice and experienced academics can become valuable sources of learning and support for each other. The culture in this study involved anatomical research and teaching and the aim of this investigation was to gauge responses of how these were elicited.

Methodological approaches for this study were utilised for their inherent strengths. For example, an independent researcher, who was not part of the research team under study, was utilised in an attempt to eliminate any element of bias. Independent coding was also undertaken to eliminate bias and introduce potential differences in interpretation of the data. Further discussions with researchers allowed for reflection and reconciliation of themes. Limitations of this study included the realisation that participants may have been hesitant to voice opinions that could have jeopardised future working relationships.

If anatomy does not advance as a discipline, it will remain a relic. It is therefore essential for anatomy to reinvent itself by engaging in research from a clinical and/or a scientific perspective.

CONCLUSION AND RECOMMENDATIONS

Autoethnography has been an under-utilised and under-examined investigative tool in the practice of anatomical research. As a methodology and as a form of presentation, autoethnography has enormous and untapped potential, demanding reflexivity and encouraging both researcher and reader to engage emotionally as well as cognitively. In this study, collaborative autoethnography, coupled with a knowledge of the literature, is being used to investigate the potential significance of a deeper understanding of research partnerships in anatomy studies. Voice, experience and theory become mutually entwined in an investigation which embodies the essence of scientist-clinician partnerships to

promote and sustain interdisciplinary research in a changing landscape. We offer the following recommendations for interdisciplinary research:

- We see collaboration to advance anatomy research as a good strategy to overcome some of the globally felt challenges to anatomy education. The community of practice involving co-authors provides an opportunity for institutions and health centres involved to benefit from sharing of experiences and resources, capitalising on each other's strengths. We hope that our own community of practice will continue to grow and develop to include other activities, academics, and institutions;
- We concur with the recommendation of Willian and Humpherson (1999) that the issue of human anatomical variation should also be discussed and reinforced during the teaching of living anatomy and physical examination, including when analysing the results of modern imaging modalities. We also reinforce the concept of anatomists playing a more important role in the teaching of human anatomical variation especially in postgraduate medical training which will contribute to medical professionals' better understanding of these variations in medical practice; and
- As there is a lack of literature in the area of research collaboration in anatomy education, the authors propose that similar studies using collaborative autoethnography be utilised to glean the experiences of fellow anatomists, thus advocating an alternative research methodology in anatomical education.

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Yammine K. 2014. Evidence-Based anatomy. Clin Anat 27: 847-852.

TABLES

Table I: List of manuscripts published to identify nodal informers in nodal areas

Cardiovascular anatomy
Absent left main coronary artery with variation in the origin of its branches in a South African population. Ajayi NO, Lazarus L, Vanker EA, Satyapal KS Anatomia Histologia Embryologia (2015) 44(2):81-85. doi: 10.1111/ahe.12109. Epub 2014 Mar 24. The intramyocardial left anterior descending artery: prevalence and surgical considerations in coronary artery bypass grafting. Vanker EA, Ajayi NO, Lazarus L, Satyapal KS. South African Journal of Surgery. 2014 Feb;52(1):18-21 Double aortic arch: an unusual congenital variation. Satyapal KS, Lazarus L, Shama D. Surgical and Radiologic Anatomy. 2013 Mar;35(2):125-9. doi: 10.1007/s00276-012-1030-z. Epub 2012 Oct 13.
Neural anatomy
Thoracic origin of a sympathetic supply to the upper limb: the 'nerve of Kuntz' revisited. Ramsaroop L, Partab P, Singh B, Satyapal KS. Journal of Anatomy. 2001 Dec;199(Pt 6):675-82. A thoracoscopic view of the nerve of Kuntz. Ramsaroop L, Singh B, Moodley J, Partab P, Pather N, Satyapal KS. Surgical Endoscopy. 2003 Sep;17(9):1498. Epub 2003 Jun 17. Galen's "Anastomosis" revisited Naidu L, Ramsaroop L, Partab P, Satyapal KS. Clinical Anatomy. 2011 Dec 12. doi: 10.1002/ca.22011. [Epub ahead of print]
Osteo-anatomy
Acromial morphology and subacromial architecture in a South African population N Naidoo, L Lazarus, SA Osman, KS Satyapal International Journal of Morphology – IJM 024.15 An anatomical investigation of the carotid canal N Naidoo, L Lazarus, NO Ajayi, KS Satyapal Folia Morphologica, Manuscript number: FM #38880

Table II: Interview Schedule

1. Name:
2. Age:
3. Sex :
4. Race :
5. Qualification:
6. Speciality/Discipline:
7. How long have you been practicing in your specialty or discipline?
8. Have you conducted research exclusively in your specialty or have you engaged in cross discipline research. May I respectfully request you to explain further.
9. Have you found collaborative research work beneficial and how has this collaborative research assisted you in your practice?
10. What is regarded as being cutting edge research in your field and how does this work extend it?
11. Where do your research strengths lie? Can you please elaborate.
12. What are your research weaknesses? Please explain how you would aim to improve this?
13. Please explain how this research work has influenced your teaching, if at all. In what ways have you been able to bring the insights of this research work to your courses at either undergraduate or postgraduate level?
14. How would you involve postgraduate or undergraduate students in such research?
15. Do you have any additional information that you would like to share?

Table III: Sample demographics of Nodal informers

Nodal Informers (Co-authors) (n=10)	
Age range (years)	25-68
Gender	
Male	6
Female	4
Race	
White	2
African	1
Indian	7
Coloured	-
Qualification	
PhD	2
MBChB & PhD	2
MBChB	3
MSc/ M Med Sci/ M Phil	2
Speciality/ Discipline	
General Surgery	1
General Physician	1
Orthopedic surgeon	1
Cardiothoracic surgeon	2
Clinical Anatomy	5
Range of number of years practicing in discipline	7-40 years

INTERFACE

Chapter 3 gave an autoethnographic account of practices related to research and the teaching and learning of anatomy using reflection and memory work. Hence, Chapter 4 provides a further detailed account of national faculty perceptions regarding pertinent disciplinary issues, student perspectives of their experiences in dissection of cadaveric material and the use of mobile learning in anatomy education.

Churchill et al. (2011) state that pedagogy "is the science and art of education including teaching methods and practice." In the following chapter I have engagement in the studies as researcher and educator. Klopper (2000) describes an educator as a facilitator and creator of a learning climate who accompanies the student on his/her learning path, who acts supportively and who intentionally creates a context conductive to learning within the nature and guidelines of constructivist learning. Scrooby (2012) outlines the characteristics and skills of an effective educator which are to be knowledgeable, enthusiastic, confident, effective communicators, committed, compassionate, curious, patient and persistent, willing to share and collaborate, resourceful and inventive, well organised, optimistic and ethical to promote effective teaching-learning of anatomy for the overall purpose of lifelong learning.

CONTRIBUTIONS TO THIS CHAPTER

This chapter is comprised of three papers that have been submitted for publication; one is *in press* and the remaining two are currently under review by the Journals.

Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education
L Lazarus, R Sookrajh, KS Satyapal
African Journal of Health Professions Education: Manuscript number: 871

Reflective Journals: Unmasking student perceptions of anatomical education
L Lazarus, R Sookrajh, KS Satyapal
Folia Morphologica: Manuscript number: #48600; IN PRESS

'Anytime, Anywhere'- Tablet technology in medical education
L Lazarus, R Sookrajh, KS Satyapal
British Medical Journal-Open: Manuscript number: BMJ-Open-2016-013871

CHAPTER 4

Compendium of Anatomical Tales: How art thou anatomy?

SCIENTIFIC MANUSCRIPT 3

Title	**:**	**Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education**
Authors	**:**	L Lazarus[1], R Sookrajh[2], KS Satyapal[1]
Name of institution	**:**	[1]Department of Clinical Anatomy School of Laboratory Medicine and Medical Sciences College of Health Sciences University of KwaZulu-Natal Westville Campus Private Bag X54001 Durban South Africa 4000 [2]Department of Curriculum Studies School of Education College of Humanities University of KwaZulu-Natal Edgewood Campus Mariannhill Road Pinetown 3610

ABSTRACT

Reflecting on teaching is commonly cited as a fundamental practice for personal and professional development. Educational research into the scholarship of teaching and learning anatomy includes engaging in discipline-specific literature on teaching, reflecting on individual teaching methods and communicating these findings to peers. The aim of this paper is formally to assess the opinions of senior anatomy instructors regarding the state of anatomical knowledge in their respective institutions. The context of the paper derives from ongoing debates about the perceived decline in standards of anatomical knowledge of medical students and postgraduate learners.

An open-ended questionnaire was devised consisting of eight direct questions seeking opinions on anatomy teaching, knowledge, and potential educational developments and general thoughts on the teaching of anatomy to medical students. These were distributed to senior anatomy Faculty (identified by the author by their affiliation with the Anatomical Society of Southern Africa) based at the eight national medical schools within the country.

A number of key themes emerged. Most senior faculty felt that the standard of medical education at their respective institutions was ‘good.’ However, emphasis was also placed on the ‘quality of teaching’ incorporating clinical scenarios. There were also indications that staff are split into those that are keen to do research and those that are happy to provide teaching to medical students as their primary function. Several challenges were also highlighted such as time constraints within the medical curriculum, the lack of cadavers to reinforce knowledge and gain depth perception and lack of appropriately qualified staff. Recommendations included fostering partnerships with both clinicians and medical scientists into the anatomy curriculum thus improving teaching and research.

INTRODUCTION

Anatomy has been the cornerstone of medical education for hundreds of years[1]. However, in the recent past, anatomical teaching has become a remarkably controversial area of medical education[2]. In South Africa, the literature pertaining to anatomical education has focussed on the decline of the discipline in the medical curriculum[3], the clinical relevance of problem-based teaching[4], the relevance of clinical anatomy as the basis for clinical examination[5], the challenges facing medical education in South Africa[6] and the improvement of academic performance of medical students by the implementation of problem-based learning[7].

In addition, South Africa has, in response to international tendencies in higher education, also employed outcomes-based education with the need for student competence as outlined by the recommendations and guidelines of the South African Qualifications Authority[8] and the Health Professions Council of South Africa[9]. Raubenheimer and colleagues (2015) [10] have recently highlighted the role of the *Undergraduate Education and Training Subcommittee of the Medical and Dental Professions Board (HPCSA)* in developing core competencies for clinical practice in South Africa in association with the different training institutions and the South African Committee of Medical and Dental Deans. These competencies, when applied to anatomical education, comprise "theoretical knowledge of anatomy, having the skill to apply the knowledge three-dimensionally (practically) and being able to apply the knowledge in clinical contexts[8,10,11]. However, the HPCSA has not defined a national core anatomy curriculum; thus each University has implemented their own anatomy curriculum. According to Kramer et al., (2008) [12], whilst these curricula have some similarities, they also differ markedly from each other.

Irrespective of curricula changes, an accurate and comprehensive knowledge of anatomy undoubtedly is essential for safe and sound clinical practice[13,14,15]. The subject of anatomy is well known to be a discipline that presents most students with a challenge. It is a unique subject in that "it represents a huge set of facts, codified in specialized language" which requires "its own customary approach to teaching and learning" [14]. Anatomical competence involves an in-depth understanding and appreciation of the human body through the ability to assimilate and apply knowledge [15]. According to Smith et al., (2014) [16], the teaching of anatomy also has the ability to influence student aptitude, as it would affect the different learning approaches that students adopt. The literature presents us with a polemic relationship between two key perspectives on learning anatomy viz. cadaveric dissection (the traditionalist approach) versus the latest computerised materials (the modernist approach) [17].

In addition, many anatomists and clinicians are of the opinion that anatomy is in a state of crisis[18,19,20]. This impression has been brought on by a reduction in the number of hours dedicated to anatomy [21],

the shortage of cadavers to sustain wet laboratories[22], the lack of gross anatomy teachers and the lack of structured programmes [20].

Since this qualitative study is unique, it is the first in South Africa to investigate professional anatomists' perceptions of anatomical competence of students and teaching methods at their respective institutions as they represent a group of individuals who are committed to their discipline.

METHODS

Design

This was a descriptive study with a qualitative focus which aimed to acquire an understanding of the perceptions of anatomists with regard to their disciplines from the eight national Medical Schools in South Africa (Table 1).

Sampling

The researchers chose a small sample for this qualitative inquiry, as this enabled us to understand the central phenomena of the study[23]. Lecturers involved in teaching anatomy to health science students were purposively sampled. The number of years of teaching experience ranged from 6-40 years. In South Africa health science students comprise medical, nursing, physiotherapy, occupational therapy, speech therapy, dental therapy, oral hygiene, optometry and pharmacy students. Fifteen lecturers agreed voluntarily to participate in the study. Furthermore, two additional clinicians were sampled to validate views regarding anatomical competence. Ethical clearance was obtained from UKZN's Biomedical Research Ethics Committee (BE386/15) and lecturers gave informed consent to participate in the study.

Data collection instruments

We used open-ended questionnaires to obtain data to gain a real understanding of lecturers' perceptions (Appendix A). The rationale behind these questions was to allow participants to reflect on their teaching experiences and to provide insight into views regarding student knowledge and teaching methods. The questionnaire was initially piloted using three lecturers; thereafter the researchers decided to add questions for clarity (Questions 6 and 7).

Data analysis

The researchers used analytical induction [24] to uncover categories within the set of data to derive an understanding of typical perceptions held by instructors. We did this to allow for patterns, themes and categories of analysis to develop from the data[25]. The first author (LL) used a colour-coding system to organise the data into categories by clustering ideas that pertained to the same concept. In order to

validate the data, two other academic staff members, who were not involved in anatomy teaching, coded the data, thereby ensuring triangulation. According to Denzin and Lincoln (2011) [26], triangulation is a procedure that reduces the likelihood of data being misconstrued and involves the combination of two or more investigators within one study to increase the credibility of findings and to limit prejudice. The first author then met with the independent reviewers to determine categories from which broad themes were identified and extracted.

RESULTS

Demographic data

The sample of this study consisted of a total of 18 participants of whom 9 were male and 9 were female. These participants came from seven of the eight national medical schools (Table 1). The highest qualification of the majority of respondents was a Senior Doctorate in Medicine (1), PhD (8) with 2 of these also being medically qualified. Qualifications of other staff included MBChB only (4); Master of Science (3) and Master of Medical Science 2. Of these participants, one had a postgraduate qualification in education and training practice. In terms of years of teaching experience, 9 of those surveyed had greater than 20 years of experience, whereas only 2 respondents had been teaching for less than 6 years (Table 1).

Thematic analysis

The recorded data produced two major themes viz. (i) best practice outcomes with scarce resources in Anatomy teaching and (ii) instrastructural challenges in the teaching and learning of anatomy. Subthemes are further reported within each respective theme.

Theme 1: Best practice outcomes with scarce resources in Anatomy teaching

Faculty from the various institutions held a dichotomy of opinion with regard to the adequacy of anatomical knowledge and subsequent student competence.

Teaching for practice

Some anatomists were of the view that excellent teaching of human anatomy was maintained at their Institution.

"We teach students that which they need to know to make them confident practitioners and equip them to be of optimum service to their clients/patients" (Participant 2)

Partnerships with clinicians

It was suggested that anatomy be taught in an interdisciplinary manner with input from gross anatomists and fostering partnerships with clinicians and not be taught in isolation as is the status quo.

"It would be good if it (anatomy) could be expanded to relevant clinical problems. It is a time factor but must be considered. I think that anatomy must be taught between anatomists and clinicians (radiologists). Have seminars with multiple disciplines in selected topics e.g. Respiratory disease can have anatomist, pathologist, clinician and radiologist. Can include pharmacology)."
(Participant 16)

"Students are taught aspects of anatomy in isolation i.e. histology, embryology and morphological anatomy are taught as separate subjects at some institutions and this hinders the students ability to integrate the knowledge into a clinical setting." (Participant 10)

Need to interact more with clinicians and involve them in teaching our students in 2nd year (Participant 7)

Some educators were also of the view that anatomical knowledge was inadequate for practice due to the fact that the subject was being taught by non-clinicians.

"Because I think a lot of the anatomy is taught by, or the basic science teaching is by non-clinicians, so I don't think so." (Participant 17)

Integration of basic sciences into clinical application

Educators also felt the need for the anatomy to be taught as clinically relevant, as students find it difficult to integrate basic science information and to apply this in clinical scenarios.

"It all bulges [comes] down to approach. I must add that Anatomy is first of all a discipline to provide information of the normal structure. The emphasis on 'clinical' Anatomy should be to clearly define when it is presented to a first time student of Anatomy, a student in the clinical years of undergraduate training and a postgraduate student that needs a refresher course in Anatomy for a specialisation degree in any of the clinical disciplines. I want to believe every Anatomy department makes provision for clinically important Anatomy and this will vary from one institution to another within a country and between countries." (Participant 12)

"They struggle to make the connection between the anatomy and a clinical setting. These students are rote learning and it does not help them apply the knowledge they have learnt." (Participant 13)

Resources: Cadaveric dissection

Educators felt that cadaveric dissection was indispensable as it provided an holistic and 3D appreciation of the human structure and promoted visual-spatial ability.

"Yes, it (cadaveric dissection) is essential – it provides students with a holistic view of the human structure and anatomy as well as give [giving] them the initial skills that will be used during later clinical rotations." (Participant 2)

In addition, educators acknowledged the role of the cadaver in assisting the student to understand humanistic values such as death and dying.

"Its (cadaveric dissection) essential. Gives a 3D perception of the anatomy which is important for the understanding of anatomical relationships. Helps the student to understand death and cope with the perceptions of dying." (Participant 10)

Resources: Multimedia, plastinates and imaging

There was consensus among educators that computer software packages, plastinated specimens and radiological images should be used as supplementary teaching modalities and should not replace cadavers.

"3D animations are excellent for teaching. To see one structure on many different views using different modalities is essential for conceptualization and assimilation of the topic. They are aids and should not replace the experiences and skills gained with dissection of cadavers." (Participant 6)

Some educators expressed concern regarding the accuracy of plastic models.

"Additional modalities are useful in cases where the anatomy is particularly complex e.g. Pterygopalatine fossa. The major problem with models is the level of accuracy in representing the anatomy. Computer based software is nice but it cannot replace the 3D effect of a cadaver." (Participant 10)

Core knowledge

Some instructors felt that the implementation of the block system and 'core topics' contributed to adequate anatomical knowledge.

"We have a list of 'core topics' that we cover which was reviewed by Faculty as a whole (including a cohort of clinicians)." (Participant 3)

Some staff also felt that some courses within the curriculum should not be taught with anatomy. They felt that this should be offered later on in training.

"Unfortunately some medical curricula are packed, not with anatomy knowledge necessarily, but with soft skills such as ethics that should be done when basic sciences have concluded." (Participant 6)

Theme 2: Infrastructural challenges in the teaching and learning of anatomy

Anatomists were at pains to point out some challenges that are not defined by the subject area per se but are general constraints of contemporary medical programmes. Participants consistently highlighted difficulties produced as a result of increased student numbers, reduction in the time devoted to anatomy teaching, inadequately trained staff and the shortage of cadavers.

Increase in student numbers

"Increased student numbers and a decrease in lectures have made this (teaching) difficult." (Participant 4)

Reduction in anatomy teaching time

"The general challenge of diminishing anatomy time has precipitated into severe reduction in context and length." (Participant 14)

Staffing

"More experienced staff required to guide students" (Participant 7)

Shortage of cadavers

"The lack of cadavers to reinforce knowledge and gain depth perception." (Participant 6)

DISCUSSION

A review of the available literature, pertaining to anatomical education in South Africa, revealed that there is a dearth of studies associated with the perceptions of staff related to their views regarding anatomy teaching and learning.

Despite the fact that only 18 anatomists participated in the current survey, the results provide us with a snapshot of the current state of medical students' knowledge and understanding of anatomy including the use of different teaching modalities in South Africa from the perspective of their educators. Collectively, the respondents in this study represent the voice of well-qualified ($^{9}/_{17}$ with PhD qualifications) and experienced medical anatomy educators ($^{6}/_{17}$ have more than 30 years of experience).

There were opposing views with regard to anatomical competence of students. Some educators felt that students possessed adequate anatomical knowledge whilst others expressed quite vehemently that students did not possess an adequate understanding of the subject for safe and applied clinical practice; the latter perception in this study concurs with the views articulated by Lazarus et al., (2012) [27] and Singh et al., (2015) [28]. The views expressed by some South African anatomists concur with that of Sugand et al., (2010) [29] with regard to the reduction in anatomy teaching time, decreased numbers of sufficiently trained teaching staff and an overall reduction in dissection happening at the medical schools countrywide. The need for more experienced anatomists concurs with that reported by Bergman et al., (2014) [30] who stated that it is currently extremely rare for anatomy to be taught by dedicated, well-trained, medically-qualified gross anatomists. Since non-medical anatomy teachers have a limited understanding of why the subject is relevant from a clinical perspective, the decline of medically qualified anatomists was viewed as a limitation in students' mastery of anatomical knowledge[31]. In addition, generalist scientists with no formal training or experience in anatomy are being employed by Institutions to teach gross anatomy. Additionally, the criteria governing these appointments are based on the fact that Institutions are employing faculty whose first interest is research to promote research skills and income generation[32]; thus adopting the University agenda to 'publish or perish' [33] rather than to make a commitment to teaching. Clinicians are concerned primarily with patient care and, even if they are interested in teaching, they are restricted by large workloads [15]. Additionally, universities offer distinctly unattractive salary structures to medically qualified anatomists, thus discouraging faculty with clinical qualifications from taking up teaching positions [13]. The above factors have been suspected as having a negative impact on student's anatomical knowledge. This is in agreement with Prince et al., (2005) [34] and Sugand et al., (2010) [29]; thus undermining the importance of human anatomy as a pillar in medical education.

In South Africa, a national core curriculum for anatomical education is non-existent and each University is responsible for their own anatomy curriculum. This creates a wide diversity in the modes of teaching within human anatomy departments with varying emphasis on the different methods individually or in combination[1], resulting in different curricula, different teaching time allocations, staffing numbers and composition. If a core curriculum were in place, both basic and clinical teachers would be cognisant of what students are expected to learn; thus assisting students to achieve that knowledge [15].

This study concurs with Gangata et al., (2010) [35] and Bekele et al., (2011) [36] who report that 90 per cent of the medical schools in Africa have retained dissection, despite challenges such as a shortage of cadaveric material for teaching and poor body donor programmes. This study also agrees with Ogunranti (2008) [37] who cites a need for change given these challenges of reduced time, appropriately qualified staff and shortages thereof, declining financial allocations by Universities and an increase in student numbers.

Collaborative teaching with clinical staff provided many positive accounts throughout this research. It appeared to be a key point that anatomists consistently brought up to keep teaching grounded in relevant clinical application.

According to Fitzgerald et al., (2008) [2] the time spent studying anatomy is worthless without quality teaching resources to underpin it. Traditionally, learning anatomy has been dissection-based [1]. South African anatomists strongly advocate the use of cadaver-based dissection as this modality allows haptic appreciation of 3-D anatomy unlike any other teaching facility. They further expressed that learning anatomy on computerised teaching aids, plastinates, and imaging were supportive tools but should not replace the cadaver. According to a recent news report [38], the President of the Anatomical Society, stated that using the cadaver also helps with developing the emotional skills of students, something that computer graphics can never replace.

> *"It is extremely important for any medical or medical-related student to learn the anatomy first hand from a human body, knowledge can never be replaced by a computer program or by handbooks. This is leading to huge problems for all of us at medical schools as we do not have enough cadavers to do the training that we need to do."*
>
> [http://www.sabc.co.za/news/a/c15ba30049787268a0cda1623266b54e/Shortage-of-cadavers-at-SA-universities]

Recommendations

Ideally, the professional accreditation body viz. the HPCSA, in consultation with local medical education societies need to consider a national core curriculum to be adopted by all medical schools countrywide to create standardised norms for the discipline. It is also recommended that clinically-relevant teaching that encourages the application of anatomy learning to medical situations, particularly those situations that are commonly encountered by junior doctors, be implemented. As recommended by Bergman et al., (2011) [15], it is not inconceivable for anatomists and clinicians to agree upon a core curriculum. Louw et al., (2009) [39] highlighted the peculiarities between 'general"' and 'specific' anatomies and how these can be taught using different teaching methods, learning materials and assessment programmes. The development of postgraduate courses in anatomy should be formulated to address the inadequate anatomical knowledge after graduation. Such courses will ensure that early

postgraduate training programmes include formal teaching in anatomy. In addition, a review of the formal clinically applied anatomical offerings in postgraduate specialist courses in medicine may be necessary. Staffing issues can be addressed by capacitating current faculty and by allowing the appointment of only skilled gross or clinical anatomists to teach within the discipline. It is recommended that the Anatomical Society of Southern Africa, in consultation with anatomy departments within the country, set up accredited training programmes for anatomists. It goes beyond the scope of this paper to discuss the enhancement of professional recognition, but we would recommend Bergman et al., (2011) as a start for anyone interested in further reading.

Integration of the basic sciences such as anatomy with clinical medicine is a challenge that can be overcome by fostering partnerships between clinicians, academics and students by bringing alignment to their perspectives as expressed by Participant 4 in this study:

> *"I think that we need to diversify the different methods that we employ to deliver our material. Students need regular assessment activities in order to ensure that they master the content and application - Vertical and horizontal integration with other disciplines."*

There is a need to interrogate the perceptions of teachers in clinical medicine regarding student competency of applied anatomical concepts in practice through in-depth analyses such as interviews.

Study limitations

There are a number of limitations to the current study. Response rates from faculty were poor; no staff from one of the medical schools in the country (Walter Sisulu University) responded to the questionnaire. It is acknowledged that the findings of this study may not be generalisable beyond South Africa. It would be of great interest to examine the views of senior medical students and junior doctors regarding their perceptions of the anatomy that they were taught and how this has impacted on their clinical competence. It would also be simultaneously necessary to ascertain their views on which teaching tools they found beneficial and whether this methodology had in fact perpetuated life-long learning. A strength of the study is that it is unique in that it has for the first time ascertained views on anatomical research in our country and these are not just anecdotal sentiments but rather reports on responses from very senior anatomists.

CONCLUSION

This study serves to highlight the challenges faced by anatomy educators in South Africa. A core knowledge of anatomy is essential and learning objectives should be the same across Universities whatever teaching approaches are adopted within a curriculum. Faculty consistently indicate the need for human cadaveric dissection as a teaching tool, supplemented by a variety of additional resources. The challenge should not be to determine supremacy of one methodology over another but rather to maximize the learning benefit available from the different methods. In summary, we believe this work highlights a clear need for research that addresses not just the learning of anatomy, but also advocates the need for anatomical requirements of cutting edge clinical practice. We invite our colleagues to forward comments and to debate our suggestions.

CONFLICT OF INTEREST

None

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TABLES

Table 1: Profile of participants (n=17) in the survey conducted

Institutions (Number of participants)	Qualification				Years of experience			
	PhD	**MBChB**	**MSc/ M Med Science**	**Teaching qualification**	**0-10**	**11-20**	**21-30**	**31-40**
SefakoMakgatho Health Sciences University (2)	0	1	1	0	1	-	-	1
University of Cape Town (2)	2	0	0	0	-	-	-	2
University of the Free State (1)	0	1	0	0	1	-	-	-
University of KwaZulu-Natal (6)	2	2	2	0	3	-	1	2
University of Pretoria (1)	1	0	0	0	-	1	-	-
University of Stellenbosch (1)	1	0	0	0	-	-	-	1
University of the Witwatersrand (5)	3	2	1	1	1	2	2	-
*Walter Sisulu University (0)	-	-	-	-	-	-	-	-
Overall (17)	8	6	4	1	6	3	3	5

There were no respondents from Walter Sisulu University

APPENDIX A: SCHEDULE OF OPEN-ENDED QUESTIONS FOR FACULTY

1. Are you currently or have you previously been involved in clinical teaching? If so, for how long? May I respectfully request you to explain further?
2. What are your views regarding anatomical education at your Institution?
3. In your opinion do you think that students are taught clinically important anatomy? May I respectfully request you to explain further?
4. In your opinion do you think that students you come across have the proper general anatomical knowledge and the ability to interpret it in a clinical setting? May I respectfully request you to explain further?
5. Do you think that cadaveric dissection to teach anatomy is necessary? Please explain further.
6. What are your views with respect to the use of any additional teaching modalities in anatomy, for example the use of plastinated specimens, the use of computer software packages and radiological images? Further, do you have any suggestions of what teaching resources should be used to teach anatomy adequately?
7. Do you have any suggestions to improve the delivery of anatomy knowledge at undergraduate and postgraduate levels?
8. Do you have any additional information that you would like to share?

SCIENTIFIC MANUSCRIPT 4

Title	**:**	**Reflective Journals: Unmasking student perceptions of anatomical education**
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ABSTRACT

In medical education, reflection has been considered to be a core skill in professional competence. The anatomy laboratory is an ideal setting for faculty/student interaction and provides invaluable opportunities for active learning and reflection on anatomical knowledge. This study was designed to record student attitudes regarding human cadaveric dissection, to explore their experiences of anatomy through an analysis of their journal-reflective writings and to determine whether or not this type of creative writing had a beneficial effect on those students who chose to complete their reflective writings. A total of seventy-five journals from Medical and Allied Health Science students were collected and analysed. Results were categorized according to the following themes: (i) Dissecting room stressors (27.6 per cent); (ii) Educational value of dissection (26.3 per cent); (iii) Appreciation, Gratitude, Respect & Curiosity for the cadaver (18.9 per cent); (iv) Positive and negative sentiments expressed in the dissecting room (25.8 per cent); (v) Benefit of alternate teaching modalities (4.6 per cent); (vi) Spirituality/Religious Beliefs (3.7 per cent); (vii) Shared humanity and emotional bonds (3.69 per cent); (viii) Acknowledgement of human anatomical variations (3.2 per cent); (ix) Beauty and complexity of the human body (1.8 per cent) and (x) Psychological detachment (0.9 per cent). Students appreciated the opportunity to share their emotions and reflect on the humanistic dimension of anatomy as a subject. Student reflections illustrated clearly their thoughts and some of the difficult issues with which they wrestled. The anatomy laboratory is seen as the budding clinician's first encounter with a patient, albeit a cadaver. This was the first time that reflective journals were given to students in the discipline. Reflective journals allow students to express themselves in an open-ended and creative fashion. It also assists students to integrate anatomy and clinical medicine and assists in applying their basic anatomical knowledge in an authentic, yet safe environment.

Key words: Reflection, journal writing, anatomy, medical education, cadaveric dissection

INTRODUCTION

Reflection, as defined by John Dewey, is a "purposeful form of thought provoked by unease in learners when they recognize that their understanding is incomplete" [28]. It is also regarded as a process regarding thinking about and exploring an issue of concern which is triggered by an experience [11]. Specifically, in medical education, reflection has been considered to be a core skill in professional competence [47]. Journal writing has been considered as a means to facilitate reflection and to allow students to express feelings regarding their educational experiences.

According to the literature reviewed, reflective learning has become increasingly popular within the domain of medical education [81] and other health-related professions such as nursing [4, 63]. Reflection, using journal writing, has been described and explained in many different ways [87] and has been utilised in a variety of professions such as nursing [24, 36, 72, 95], physical therapy [91, 92]; occupational therapy [85] and teacher certification [13, 17].

The anatomy laboratory is an ideal setting for faculty/student interaction and provides invaluable opportunities for active learning and reflection on anatomical knowledge. Despite reduction in its importance, time allocation and status within the domain of anatomical education in modern curricula, anatomical knowledge remains the bedrock in medicine and related health professions [2]. Human dissection within gross anatomy courses usually occurs early in undergraduate medical and allied health science curricula [16]. There have been many studies conducted worldwide on the role of dissection and its effect on the encouragement of humanistic qualities of respect, empathy and compassion, all of which embrace the concepts of socialisation and professionalisation in medical education [22, 31, 32, 65, 67, 73, 84]. Hafferty (1988) [31] further stated that the experience of dissection is regarded as an emotional rite of passage which promotes the process of changing over from layperson to doctor. Bertman and Marks (1989) [7] reported that this ritual takes place via a psychological process of which very little is yet known. According to Woodward (1998) [96], reflective journal writing allows students to ask questions, reflect on their own learning processes and to make a connection between their theoretical understanding and personal experience in practice.

Dissection offers students opportunities to recognise and to come to the realisation that the cadaveric donors that they are exposed to, were once a living people with a name, family and life history. There is a dichotomy of opinion in the literature with regard to the role played by the cadaveric donor. Newell (1995) [58] labelled dissection as the "royal road" with the cadaver that students explore, in essence, being the "first patient" [15, 91]. Prakash et al.,(2007) [70] state that when dissecting a cadaver, the student is faced with the reality

of life - morbidity and mortality -as well as the remarkable responsibility of a clinician to care for a patient. Other authors such as Winkelmann and Güldner (2004) [94] and Bohl et al., (2011) [9] reported that students see the cadaver as a great teacher, thus attributing a social role and status to it. The student-cadaver encounter in medical education is regarded as a "nodal point" [68] – a moment in time which can result in compassionate detachment on the part of the student that is essential if the future clinician is to cope with issues such as death and bereavement [23] and causes them to reflect on issues of human dignity and grief [34]. Despite this detachment, students are encouraged to develop personal relationships with their cadavers based on the same gratitude and respect that is afforded to highly regarded teachers [9]. Regrettably, students may be inadequately prepared for their initial encounter with the human body and they may experience a variety of emotions [16]. The literature is replete with studies documenting dissection room experiences [76]. Many studies report on the negative emotions experienced by students, such as anxiety, disgust and/or apprehension. [18, 19, 30, 35, 60, 78, 79, 88]. According to Shapiro et al. (2006) [78], this anxiety is both natural and healthy, especially if it leads to reflection and self-analysis. O'Carroll et al., (2002) [60] reported that stress is heightened by intensive psychological and physical reactions with some students experiencing sleep disorders. Nnodim (1996) [59] reported students experiencing intensive anxiety which can reach the level of post-traumatic stress [25]. Physical reaction to cadavers include revulsion at the sight and smell of it, shock at confronting death, desecration and dismemberment, violation of cultural taboos, dehumanisation and invasion of privacy [2]. On the other hand, some students express positive emotions towards the process of dissection [49] such as interest, excitement and the need for acquiring new knowledge [12, 54].

Further to learning to cope with the exceedingly "emotional confrontation" with the cadaver [70], additional outcomes identified in the dissecting room experience include teamwork, respect and familiarisation with the body, application of practical skills, integration of theory and practice, preparation for clinical work and an appreciation of the status of dissection within the history of medicine [49].

The attitudes and beliefs of South African medical and allied health science students regarding cadaveric dissection experiences have not been thoroughly explored. Kotze et al.,(2009) [44] reported student fears of dissecting the face, possible collapse or vomiting and feelings of sadness in a study conducted at Stellenbosch University in South Africa. South Africa is a multi-cultured society having sacred rituals with regard to handling the dead [77]. Sobnach et al., (2012) [80] reported an incidence of 17 per cent of medical students at the University of Cape Town (South Africa) who believed in an after-life with a view that the body must be kept intact after death. This importance of having an intact body is stressed in certain religious groups and is associated with respect for the ancestors and the idea of an after-life [46, 48]. Kometsi and Louw (1999) [43] further explored the concept of ancestors which is defined as "a belief, that after death,

one joins a spiritual world that works in collaboration with and in immediate subordination to God over humankind." Satyapal (2012) [77] reiterated that their 'spirits' (amadlozi) should also be at peace. Ndlovu (1997) [57] stated that ancestors are thought to communicate personal messages or messages from God to living human beings through symbols like dreams.

Another crucial concept highlighted as part of the dissection experience is the presence of human anatomical variations. Older (2004) [61] maintains that students may come across these variations as some of them may be common and are often of clinical importance. Bernard et al., (2012) [6] cited additional benefits of cadaveric dissection such as an enhanced understanding of course material and the provision of a "true picture of the human structure".

The Department of Clinical Anatomy at the University of KwaZulu-Natal is comprised of two teaching delivery sites, viz. the Nelson R Mandela School of Medicine and the Westville Campus. On both delivery sites, preparation before practical sessions usually follows a schedule and it seldom touches on how to manage emotions. There is only an introductory lecture on the rules and regulations to be followed in the dissecting room but no organised discussion or reflection on dissection experiences. In addition, a Dedication Ceremony is only conducted at the Nelson R Mandela School of Medicine campus. In many of the studies alluded to above, experiences were examined retrospectively by recollection using structured questionnaires. There have been no studies at South African Anatomy Departments that recorded student attitudes as they progressed through a dissection room-based anatomy curriculum using reflective-journaling. In this respect, our study was unique. Therefore, this investigation was designed to record student attitudes to human cadaveric dissection, explore their experiences of anatomy through an analysis of their journal-reflective writings and to determine whether or not this type of creative writing had a beneficial effect on those students who chose to complete their written reflections.

MATERIALS AND METHODS

The study sought to explore medical and allied health student experiences of anatomical teaching and learning in the Department of Clinical Anatomy, University of KwaZulu-Natal, Durban, South Africa. A total of 298 journals were distributed to all second year MBChB (n=197) and Allied Health students comprising second year Bachelor of Physiotherapy (n=40) and Medical Science (n=27) students as well as to first year Occupational Therapy (n=34) students. At the time of the study, anatomy practical teaching sessions involved full body gross anatomy dissections in the first semester of the academic calendar. All students attended two three-hour anatomy classes per week. The content of the practical sessions were pre-determined by Faculty within the Department of Clinical Anatomy at the beginning of the academic

semester. All anatomy practical sessions took place in the traditional setting of the dissecting laboratory where students had full access to resources including whole body cadaveric prosections and skeletons. Students were also given access to three-dimensional plastic models and anatomy videos to supplement cadaveric dissection in this setting (plastic torsos with muscles and ligaments, including heart and lung models). Teaching methods utilised in the dissection laboratory included small group teaching with up to twelve students per cadaver. Demonstrator-led classes (overseen by lecturers) were conducted by postgraduate students having majors in Anatomy.

The primary outcome measure of this study was student opinion of dissection-laboratory experiences related to the teaching and learning of anatomy. With the approval of the University of KwaZulu-Natal's Ethics Committee (BE386/15), all of the above students were invited to partake in the study by giving their written consent. Students were not compelled to provide demographic data in this study. Completion of the journal was purely on a voluntary basis with no compulsion on the student and was not a component of the assessment criteria of the course. With this design in mind, we chose to focus on the completed journals and evaluated student perceptions of their dissection room experiences without any extrinsic effects from assessment or course requirements.

The first (LL) and second (RS) authors summarized all narrative interpretations which were coded using a grounded theory approach [83]. Thematic content analysis was employed to identify recurring words and categories which emerged from the data and these were subsequently organised into themes. The various themes were reviewed and discussed until the authors identified an overarching theme that they felt represented the large majority of journals reviewed. The data was analysed by frequencies and percentages of the themes using QSR NVivo 10 software package.

RESULTS

A total of 75 journals were collected from students and analysed. The format varied widely from some highly reflective accounts of the writer's feelings to factual records of students' experiences in the dissecting room. A total of 217 responses were extracted from the journals. Figures 1 and 2 illustrate the coding categories of responses obtained from medical and allied health science students, respectively. From these, a total of nine themes emerged (Table 1) from the data. In order to adequately explain each of these themes, direct quotations have been extracted from the journals as follows:

Theme 1: Dissecting room stressors (27.6 per cent)

The majority of respondents cited protest mass action as a cause of limited time in the dissecting room.

"Dissecting the lower limbs felt quite rushed since we had many disruptions due to the strikes."

The smell of the dissecting room caused physical discomfort with some students

"Our cadaver is very potent and after 2 hours the smell is unbearable, the chemicals are making your nose run and your eyes burn and everyone is unhappy."

"The size of the groups I feel are way too large. For example when it came to removing the heart every single group member insisted on cutting one vessel. This kinda ruined the learning experience as everyone was pushing each other out of the way in order to get to the cadaver. Therefore, no one really got to see what was going on."

Learning challenges

"We did the anterior and posterior compartment [of the lower limb]. I found this to be challenging because there are various new names of muscles we need to know. Also trying to understand the function of each muscle is difficult as we are trying to understand the movement of the muscle, origin and insertion without actually seeing the cadaver move."

Shortage of cadaveric material and poor quality of specimens

"I didn't like the condition that some of the specimens were in. They were tattered and this made it difficult for me to identify the structure as a whole."

Theme II: Educational value of dissection (26.3 per cent)

A total of 26.3 per cent of journal responses referred to the cadaver as a useful tool for learning. The cadavers were depicted and viewed as a source of knowledge that ultimately helps others.

"It was nice to see the muscles in real life, and not only in a book."

"I felt working on the cadavers and dissecting was very helpful with understanding the body as a whole."

"Learning theoretically is just knowing what everything is but seeing, touching and identifying with variation is making a person understand the function relating to structure and how the structure is a certain way to perform a specific function."

Theme III: Appreciation, Gratitude, Respect & Curiosity for the cadaver (18.9 per cent)

Students' dominant positive emotion toward the cadaver was one of appreciation and gratitude. The responses expressed specific gratitude for the cadaver's role in contributing to the graduating of future doctors and health practitioners.

"I think those who have donated have done a noble act and deserve honour and praise because they did something right which will not only improve the knowledge of students but it also prepares future doctors and other health practitioners"

Students were portrayed as respectful and compassionate people who were curious about the lives of the donors and who tried to get emotionally close to the cadaver. There was a feeling of wanting to further protect the cadaver from any harm.

"…I couldn't help but realise that this person had once had a life, filled with happiness and joy as well as pain and sadness.

"I believe that those that donate their bodies to medical research are the real heroes here. If it wasn't for them, then medicine wouldn't be where it is today. We need these selfless individuals and their families. Our responsibility as researchers is to respect their bodies by not doing anything insulting regardless of the fact that the human soul is no longer within them."

Theme IV: Sentiments expressed in the dissecting room (25.8 per cent)

Positive emotion towards cadaver (13.4 per cent)

The cadaver often evoked positive feelings of amazement, excitement and interest in students. Dissection became the vehicle that allowed the discovery of this marvel.

"Dissecting was an amazing experience of a lifetime although it can be frightening and exciting at the same time."

"It is exciting to open the human body, it inspires and improves knowledge"

Negative emotions towards cadaver (12.4 per cent)

Dissection also appeared to arouse negative feelings of fear and anxiety, sometimes even revulsion and disgust, in some students.

"It was quite a shock seeing our cadaver for the first time. It was a very scary thing. I have never seen a dead person before, and found it very emotional to be by one. I was okay with the cadavers wrapped up, but seeing the flesh made me nauseous and emotional."

"…the sight of the cadaver makes me sick, the smell is even making things worse."

Theme V: Organized learning and Camaraderie (4.6 per cent)

Students mentioned aspects such as the advantages of prosected specimens, assistance from table demonstrators in the laboratory, benefits of learning theoretical information together with the practicals enhancing the learning experience and the importance of team work.

"Its always fun dissecting at the DH with my fellow classmates as we are able to prioritize and also make time for a little laughter. We always work as a team and this enables us to also learn faster."

"It was useful to have a lecture on the same subject matter in the morning before DH."

Theme VI: Spirituality/Religious Beliefs (3.7 per cent)

In a student body characterised by religious diversity, some students made reference to their religious and cultural beliefs. These students thought about the souls of the deceased. However, the overall impression was that there seemed to be no contradiction or conflict between their faith and their science and they understood the benefit of the cadaver**.**

"I was scared at first when I saw the cadavers covered in the plastic bag like I used to see it in the movies. I couldn't believe that those were dead people and I was going to touch and see. But there was a little excitement to see the body and dissect and see all these structures we learn in theory. But when I reported at home that I am doing this, it caused a big argument between me and father as he believes in ancestors. He told me that I am disturbing the peaceful soul as the person I am dissecting , he or she will come into my dreams. I also believe in ancestors so this made me think[ing] a lot about the excitement of seeing the internal organs and vessels."

"In my culture, it is pretty taboo to donate your body to science as it is believed that once you die, you are supposed to be buried with your forefathers and with all your organs intact and present. If your organs are missing, the elders believe that your soul won't be recognized by your ancestors and in effect your soul will never find peace and will roam freely and cause disruptions because it is restless and searching for their own."

Connection was also expressed through recognising the shared humanity of cadaver and student. Some students commented on the presence of nail polish on the cadaver's fingers. Such evidence of the cadaver's personhood triggered imagery about the life of the cadaver.

"Our first experience in the dissection hall was really emotional. I had mixed emotions as I was partially excited to see a real human body's anatomy first hand, but I was also sad when I saw the cadaver for the first time. I was able to man up and swallow my fears but when I saw our cadaver's hands, she had pink cutex and that humanized me more which brought on the waterworks."

Some students created an emotional bond with their cadaver by naming it and reflected on how access to this material had affected them personally.

"Chandler Bing is what I named our cadaver. Reason for his unique name: To give him a bubbly personality, as I imagined him to have had when he was alive."

Theme VIII: Acknowledgement of human anatomical variations (3.2 per cent)

Students also acknowledged the presence of anatomical variations.

"Discovered interesting variation of the left brachial artery. Trifurcated as opposed to bifurcated. Also does so in the arm as opposed to the cubital fossa. Such a discovery would not be possible without the use of cadavers."

Theme IX: Beauty and complexity of the human body (1.8 per cent)

Students were able to appreciate the complexity of the human body.

"Seeing the detail of the organs without the business of dissection and fear of the cadavers was fantastic as we could focus better on studying carefully the detail and appreciating our bodies make-up"

Theme X: Psychological detachment (0.9 per cent)

Some students felt that they had to separate themselves from the cadaver in order for them to get on with the job.

"I felt I had to separate myself from the cadaver and not think too much about the 'person' it once was but think of it as a 'body'"

DISCUSSION

The results of this study, following thematic analyses, illustrated that student participation in the journaling process promoted self-reflection about anatomy and health care, examined the student-cadaver relationship, probed questions about spirituality and religion and explored the emotional responses to dissection. Our study compares favourably with that reported by Shapiro et al., (2006) [78], who cited that students actively engage in reflecting on the meaning and significance of anatomy and with some students having a tendency to emotionally over-identify with cadavers, whilst others were more likely to imagine them from a humane perspective..

Students were able to articulate awe and wonder at the intricacies of the human body and express appreciation for the gift of the donor. In this study, students were able to appreciate the value of dissection concurring with numerous studies in the literature that advocate the use of dissection as a teaching tool [3, 12, 39, 40, 53, 97].

Stressors associated with dissection have been well-documented and available literature suggests that the majority of students studying anatomy adapt well to these stressors for the duration of their course [14, 25, 66, 75].

The present study, following an extensive literature survey, illustrates that students experience an array of positive (Table 2) and negative (Table 3) sentiments towards dissection. A calculated overall weighted mean of the positive sentiments (55 per cent) compared favourably with the sentiment of eagerness and excitement as reported by Mulu and Tegabu (2012) [55] (Table 2). Students' positive attitudes towards dissecting human cadavers could be related to a representation of the body, life and death leading to a future professional assuming a more humane relationship with his/her future patients [29]. In this study, an overall weighted mean of 37.4 per cent obtained for negative emotions towards cadaveric dissection concurred with feelings of fear and anxiety as expressed by Oyeyipo and Falana (2012) [62], as well as that of hesitancy to dissect the cadaver as reported by Izunya et al., (2010) [37] (Table 3).

An overall calculated weighted mean of 15.2 per cent for a diverse range of physical effects experienced by students in the dissecting laboratory was similar to that reported by various authors in the literature, viz. loss of appetite [45], dizziness [64], palpitations [27] and restlessness [2, 38] (Table 4). Table 5 outlines a number of physical and psychological factors emanating from student-cadaveric interaction. Many students complained of the smell of the dissecting laboratory [Bataineh et al., (2006) [5] (58.5 per cent), Mulu and Tebago (2012) [55] (52.4 per cent)] and thoughts about the donor [64]; these studies are akin to the calculated overall weighted mean of 55.8 per cent culled from the literature.

In this study, students took it upon themselves to name the cadaver, thereby connecting emotionally with the donor (3.7 per cent). This concurs with the report by Williams et al., (2014) [93], who stated that the practice of naming cadavers is an extremely prevalent occurrence among medical students and that this sort of inventive naming serves as a beneficial coping mechanism. Naming the cadaver "allows students to acknowledge the cadaver's personhood, while psychologically shielding themselves enough to be comfortable with the dissection" [93]. Our study also highlighted an urgent need to know, in the form of curiosity, details regarding the life of the donor (18.9 per cent), concurring with that reported by Fitzgerald (1999) [26].

Our students come from various socio-economic backgrounds and belong to a wide range of religious and cultural groups [10]. In this investigation, students commented on issues of spirituality and cultural beliefs as stressors to dissection. Sobnach et al., (2011) [80] highlighted the importance of an intact body in certain religious groups. This belief is associated with respect for the ancestors and the idea of an after-life [46, 48]. We made similar observations in our study, where students who believed in an after-life (the concept of *'amadlozi'*) (3.7 per cent) were significantly affected by cadaveric dissection.

The interpretation of student journal writing suggests a variety of expressions experienced by students. Inviting students to reflect is asking students to share their deepest thoughts [21]. Students appreciated the opportunity to share their emotions and reflect on the humane dimension of anatomy as illustrated by this quotation, *"I am thankful for this journal because it allows me to express my thoughts and feelings about my journey since it's difficult to speak to anyone else without freaking them out".* Research that provides insight into the undergraduate student experience, perceptions and outcomes of reflective-journaling, is required to validate the continued use of reflective-journaling as a way to develop reflective skills.

Recommendations for future research

Since this was the first time that such journal writing was conducted in our Discipline at our University, understanding undergraduate student experiences and perspectives could inform guiding principles and strategies that could serve to make reflective journaling more valuable and desirable. Some recommendations are as follows:

Even though Dedication Ceremonies are held at the beginning of the anatomy academic calendar, these pre-education sessions must be handled delicately and sensitively. Pre-education must include a professional counsellor so that students can opt for individual counselling if need be. The authors support the views expressed by Jones et al., (2014) [41] regarding implementation of memorial ceremonies for body donors in the anatomy programme. These ceremonies should be student driven to explore learners' reflections on humanity, respect, gratitude and personal growth.

Students should be advised to prepare mentally and emotionally before entering the dissecting laboratory so that they are emotionally involved and stimulated. Better preparation and debriefing for coping with dissection is required as there is some evidence to suggest that individuals can be 'inoculated' against the stressful effects of handling a dead body [51]. Hafferty (1988) [31] referred to the cadaver as the "ambiguous man" to highlight its material (i.e. of being a teacher and not viewed as a mere medical object) as well as its personal qualities (name, age, cause of death). Several authors suggest that supplying as much personal and medical history of the cadaver would reinforce respect and compassion to interested students [19, 69, 86, 88, 89]. This may alleviate some of the stresses experienced by students. We also support the recommendations by some researchers that there is a need for the inclusion of courses on emotions and how to manage them in the anatomy curriculum [50] and concur with Nnodim (1996) [59] that a formal course on death and dying should begin at the Pre-clinical level and extend into the clinical years.

We support the views expressed by Weeks et al., (1995) [89] that students should be encouraged to talk about the thoughts and feelings aroused by dissection and to reflect on these experiences. The authors propose that a commemoration ceremony be held at the end of an emotionally and intellectually demanding course to give students closure.

One limitation of this study is that we did not have detailed statistical socio-demographic data on the students to weight the results for representativeness. However, a strength of the study is the successful implementation of a research tool to document student-dissection room experiences. In future studies, we would like to investigate the possible role of creative journaling as a component of the course assessment.

Educators need to hold onto their ideals and continue to "teach to change the world" [21] and we support Hildebrandt's (2016) [33] recommendation that "it is the duty of anatomical educators to prepare, accompany and support students during the challenging situation of the dissection course". Perhaps developing a method where students are given more information about their cadaver, while protecting the anonymity of the donor and family would be beneficial in alleviating strong emotional student responses. Anatomy educators are correct in pursuing the teaching and learning of reflection in undergraduate education and it behoves them to utilise various tools and strategies to facilitate the growth of students into reflective practitioners. Reflective activities provide students with opportunities to think critically and can provide personal learning, transformation and better-understanding leading to self-actualisation. Such a student with improved personal attributes will be better positioned to provide excellent healthcare. If reflective learning is to be made a course requirement, it is important that the assessment is formative and does not distort the demonstrated benefits. Anatomists need to explain in detail the steps necessary for dissection and that dissection is performed with the respect of legislation, ethics and human rights.

CONCLUSION

We believe that our study offers essential information on encouraging self- reflection regarding anatomy and health care, examining the student-cadaver relationship, probing questions about spirituality and religion and exploring the emotional responses to dissection. This study also indicates that such journal writing may be a way of assisting students who experience anxiety and stress to first explore and then reduce these negative emotions. Integrating creative projects such as journal writing into anatomy courses should be encouraged as it provides a means of enhancing and enriching student awareness on issues that many students wonder about but cannot express easily.

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TABLES

Table I: Thematic areas identified

	Thematic area	Incidence (%)
I.	Dissecting room stressors	60 (27.6)
II.	Educational value of dissection	57 (26.3)
III.	Appreciation, Gratitude, Respect & Curiosity for the cadaver	41 (18.9)
IV.	Sentiments expressed in dissecting room	
	Positive Emotion	29 (13.4)
	Negative Emotion	27 (12.4)
V.	Organised learning and Camaraderie	10 (4.6)
VI.	Spirituality/ Religious Beliefs	8 (3.7)
VII.	Shared humanity and emotional bonds	8 (3.7)
VIII.	Acknowledgment of human anatomical variations	7 (3.2)
IX.	Beauty and Complexity of the human body	4 (1.8)
X.	Psychological detachment	2 (0.9)

Table II: Positive sentiments expressed by students towards the cadaver

Author (year)		Sample size (n)	Incidence (%)
Eager and Excited	McGarvey et al. (2001) [52]	188	95
	Cahill and Ettarh (2009) [12]	166	19.2
	Mulu and Tegabu (2012) [55]	147	53.7
	Oyeyipo and Falana (2012) [62]	60	70
	Karau et al., (2014) [42]	75	85.3
	Kumar et al., (2015) [45]	150	60
	Purvi et al., (2015) [71]	150	70.6
Enjoyable/Fascinating/Interesting	Cahill and Ettarh (2009) [12]	166	48.4
	Dubhashi et al., (2011) [20]	415	80
	Mulu and Tegabu (2012) [55]	147	91.8
	Kumar et al., (2015) [45]	150	40
Surprise	Purvi et al., (2015) [71]	150	17.3
Helpful	Dubhashi et al., (2011) [20]	415	67
Sense of gratitude to people who donated their bodies	Dubhashi et al., (2011) [20]	415	8
Overall weighted mean			**55.0**

Table III: Negative sentiments expressed by students towards cadaver

Author (year)		Sample size (n)	Incidence (%)
Fear/anxiety	Javadnia et al., (2006) [38]	68	32
	Dubhashi et al., (2011) [20]	415	61
	Gualdrón et al.,(2011) [29]	904	23.3
	Naz et al.,(2011) [56]	500	16
	Bernard et al., (2012) [6]	212	60
	Mulu and Tegabu (2012) [55]	147	12.2
	Oyeyipo and Falana (2012) [62]	60	36.7
	Patel et al., (2012) [64]	150	24
	Agnihotri and Sagoo (2010) [2]	300	86.7
	Bob et al., (2015) [8]	138	40.6
	Kumar et al., (2015) [45]	150	61.3
	Saha et al., (2015) [74]	99	3
	Somanath et al., (2015) [82]	141	14 (M); 17 (F)
Emotional Shock	Izunya et al., (2010) [37]	104	53
	Karau et al., (2014) [42]	75	30.7
	Somanath et al.,(2015) [82]	141	24 (M); 35 (F)
	Naz et al., (2011) [56]	500	16.2
Stress	McGarvey et al., (2001) [52]	188	2
Hesitancy to Dissect the cadaver	Izunya et al., (2010) [37]	104	35
	Dubhashi et al. (2011) [20]	415	40
	Saha et al. (2015) [74]	99	24.2
	Somanath et al. (2015) [82]	141	41 (M); 50 (F)
Depression	Kumar et al., (2015) [45]	150	14.7
Horror	Purvi et al., (2015) [71]	150	12
Sense of feeling sad	Evans and Fitzgibbon (1992) [23]	167	41
	Oyeyipo and Falana (2012) [62]	60	46.7
	Patel et al., (2012) [64]	150	21.3
Overall weighted mean		**37.4**	

Table IV: Physical effects experienced by students in the dissecting room

	Author (year)	Sample size (n)	Incidence (%)
Fainting	Mulu and Tegabu (2012) [55]	147	2
	Patel et al., (2012) [64]	150	2
	Getachew (2014) [27]	206	3.4
	Purvi et al.,(2015) [71]	150	1.3
Loss of appetite	Abu-Hijleh et al., (1997) [1]	205	22.5
	Patel et al., (2012) [64]	150	2.7
	Getachew (2014) [27]	206	38.8
	Kumar et al., (2015) [45]	150	12
Dizziness	Javadnia et al., (2006) [38]	68	2.9
	Agnihotri and Sagoo (2010) [2]	300	2
	Patel et al., (2012) [64]	150	12
	Getachew (2014) [27]	206	24.3
	Kumar et al., (2015) [45]	150	2.7
Nausea	Javadnia et al., (2006) [38]	68	29
	Agnihotri and Sagoo (2010) [2]	300	30
	Mulu and Tegabu (2012) [55]	147	0.7
	Patel et al., (2012) [64]	150	22
	Getachew (2014) [27]	206	30.1
	Kumar et al., (2015) [45]	150	3.3
Vomiting	Patel et al., (2012) [64]	150	2
	Getachew (2014) [27]	206	2.4
Sweating	Mulu and Tegabu (2012) [55]	147	36.1
	Patel et al., (2012) [64]	150	8
	Getachew (2014) [27]	206	21.4
	Kumar et al., (2015) [45]	150	35.3
Palpitation	Mulu and Tegabu (2012) [55]	147	5.4
	Patel et al. ,(2012) [64]	150	0.7
	Getachew (2014) [27]	206	15
Insomnia	Patel et al. ,(2012) [64]	206	2
	Getachew (2014) [27]	206	9.2
Lack of concentration	Javadnia et al., (2006) [38]	68	38.7
	Agnihotri and Sagoo (2010) [2]	300	40
Restlessness	Javadnia et al., (2006) [38]	68	19
	Agnihotri and Sagoo (2010) [2]	300	18.7
Eye irritation	Mulu and Tegabu (2012) [55]	147	27.2
	Kumar et al.,(2015) [45]	150	63.3
Headache	Kumar et al. ,(2015) [45]	150	10
Desire to leave the dissecting room	Mulu and Tegabu (2012) [55]	147	10.9
	Kumar et al., (2015) [45]	150	9.3
No symptoms	Cahill and Ettarh (2009) [12]	166	17.4
	Patel et al., (2012) [64]	150	39.3
Overall weighted mean			**15.2**

Table V: Physical and psychological factors emanating from cadaver interaction

Author (year)		Sample size (n)	Incidence (%)
Complaints of smell	Abu-Hijleh et al., (1997) [1]	205	91
	Bataineh et al., (2006) [5]	145	58.5
	Agnihotri and Sagoo (2010) [2]	300	66.7
	Dubhashi et al., (2011) [20]	415	78
	Mulu and Tegabu (2012) [55]	147	52.4
	Patel et al., (2012) [64]	150	42.7
	Getachew (2014) [27]	206	60.2
	Saha et al., (2015) [74]	99	61.1
Fear of Infection	Abu-Hijleh et al., (1997) [1]	205	62
	Bataineh et al., (2006) [5]	145	50.3
	Patel et al., (2012) [64]	150	4
	Getachew (2014) [27]	206	33.5
Recurring visual images of the cadaver	Abu-Hiljeh et al., (1997) [1]	205	38
	Agnihotri and Sagoo (2010) [2]	300	90
Negative influence on routine activities	Dubhashi et al., (2011) [20]	415	52
Thoughts of leaving the course	Dubhashi et al., (2011) [20]	415	5
	Saha et al., (2015) [74]	99	4
Conflict with Religious beliefs	Naz et al., (2011) [56]	500	18.6
Conflict with Ethical/Moral Beliefs	Naz et al., (2011) [56]	500	37.6
Curiosity or thoughts about the donor	Dubhashi et al., (2011) [20]	415	95
	Gualdrón et al., (2011) [29]	904	84.7
	Patel et al.,(2012) [64]	150	58.7
Overall weighted mean		**55.8**	

SCIENTIFIC MANUSCRIPT 5

Title	**:**	**'Anytime, Anywhere': Tablet technology in medical education**
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ABSTRACT

Objective: The purpose of this study was to establish the use of mobile devices by learners at a selected medical school. Distribution of mobile devices was an inaugural initiative implemented by our College.

Design: A mixed methodology design using a questionnaire comprising both open- and closed-ended questions was analysed from 179 (60 male; 119 female) second year medical students registered for the Anatomy course. Open-ended questions were analysed using a thematic approach by identifying emergent ideas and concepts. Closed-ended questions were analysed using SPSS version 21.0.

Setting and participants: Second year medical students at a medical school in South Africa.

Results: Three main themes emerged viz. (i) mobile device engagement, (ii) advantages and (iii) challenges affecting use of mobile devices. A majority of learners accessed their tablets for lecture notes; more females were inclined to access these devices than males. Challenges experienced included poor wifi connectivity on and off University campus; some students were not keen on the idea of mobile devices and preferred traditional methods of teaching.

Conclusions: Mobile devices have been adopted by learners at our University. Uses of technology outlined are related to Eraut's intentions of informal learning. Integrating tablets into classes had a positive effect on student access to course material.

Strengths and limitations of this study

- Findings reveal that students engage with tablets for learning and miscellaneous use unrelated to the discipline.
- Sampling was purposive; research was limited to a single cohort of second year medical degree students. We cannot exclude an element of response bias as a large part of the sample comprised female respondents.
- Further, quantitative and qualitative studies are necessary to determine if tablets have an impact on academic performance and whether or not they encourage self-directed learning.
- University administrators are recommended to ensure that provision is made for technological support to students.

INTRODUCTION

The last decade has seen the introduction of new technology which has transformed many aspects of our culture, commerce, communication and education[1]. Mobile computing devices such as tablets, iPhones and the iPad have been swiftly implemented in many countries resulting in access to information in ways that were not possible before[2]. This article begins with a brief description of mobile learning and it is proposed that the growing use of mobile technology at universities is the most current trend forcing educators to evaluate its merits.

Mobile learning is defined as "any type of learning that takes place in learning environments and spaces that take account of the mobility of technology, mobility of learners and mobility of learning."[Reference missing] As mobile technology develops, it creates new opportunities for enhancing the learning experience of students at all levels of education[3]. Cobcroft et al., (2006)[4] reported that "mobile technologies are able to support learners' engagement in creative, collaborative, critical and communicative learning activities." Traxler (2007)[5] further emphasised that mobile learning offers a unique opportunity to support learning that is personalised, authentic and situated thus facilitating a wide variety of teaching methods. The growing use of mobile technology at Colleges and Universities is the most current trend forcing educators to evaluate its merits and The College of Health Sciences (CHS) at our University has implemented a Visual Learning Project and over 1400 health science students have received new Proline Tablet PCs. This technology was the first in South Africa to provide such a platform to stream live lectures, and to record lectures for later on-demand viewing. According to the Information Technology Department at the university, "the live lecture streaming incorporates an interactive classroom, where students can ask the lecturer questions electronically, and students can respond to questions, surveys and polls from their seats in the lecture room, or from a remote location. College management said this new solution opened up exciting opportunities that could even allow international lecturers to lecture to the student population. The new technology would allow lecturers to reach the more remote areas of the university community; proving especially beneficial to CHS students when fulfilling the clinical service requirements of their degrees." (UKZN website; accessed 21 July 2016)[6]. Mobile learning presents students and faculty with a unique opportunity to access information instantaneously, regardless of location[7].

The main advantages of using tablet technology embrace the following perceptions viz. using software applications to enhance creativity, critical thinking and encouraging greater interaction among students and faculty[8]. The benefits of using the tablet have also included a reduction in the amount of paper used and a reduction in textbook costs as students have opted for electronic versions of the text. Engagement with tablet-pcs in academic programmes creates a positive educational experience[9]. Miller (2012)[10] reported that

not only do tablet-pcs have applications that serve as study aides and productivity tools for students, but students are also able to use applications'(apps)' to help create flashcards for studying, including retrieving and editing documents on Google Docs for assignments. There are hundreds and thousands of applications, some free and some requiring paid subscriptions. These applications are available in a wide range of categories and are tailored for specific medical disciplines such as Medscape, Medical Tools, Gray's Anatomy-Atlas, Medical Abbreviations, Harrison's Manual of Medicine, Anatomy Learning-3D Atlas, MediApp, Resuscitation, iGyno and O&G App. Further, some authors recommend that the design of tablet-pcs should combine e-reading capabilities with web-browsing, plus an assortment of applications that facilitate the integration of information by making information conveniently available, including creating a richer set of course notes[11 12].

Ellaway (2014)[13] categorised mobile use by medical learners into four groups viz. (i) *logistics* (when learners use their devices for personal information management such as email and texting); (ii) *personal* (when learners use their devices for social and entertainment purposes such as social media and gaming; (iii) *learning tools* (when learners use their devices for undertaking learning tasks such as note taking and (iv) learning content (when learners use their devices as a source of information such as checking drug interactions. This categorisation will used a framework to represent data later on in this paper.

Anatomy in Higher Education

Anatomy is an integral part of any medical degree. Within anatomy programmes, students are required to create a comprehensive and sophisticated understanding of basic anatomy, and then apply that information to clinical care[14]. Anatomy requires students to learn a large volume of Latin terminology and functions including muscle names, origins, insertions, joint, connective tissue and cellular, micro and gross anatomy. Traditionally, students use a rote or surface learning approach and have stated that anatomy is "boring, hard, dull" in previous literature [15 16].

The nature of anatomical education has transformed substantially over the past decade due to both a new generation of students who learn differently from those of the past and the explosion of advances in anatomical imaging and programing. Medical students of today are products of the "interactive generation"[17]. Millennial generation learners (sometimes referred to as digital natives) are defined as individuals whose development has been infused with technology and these individuals possess extensive experience with digital exploration, gaming and communication and are claimed to be adept with user-friendly digital devices[18 19].

Anatomy teaching in medical schools has been traditionally based around the use of human cadaveric specimens, either taking the whole body specimens for complete dissection or as prosected specimens[20]. The debate on teaching via the conventional pedagogy of cadaveric dissection versus the computer and more innovative modalities has raged on for the last decade[21]. Those who advocate retaining this traditional learning exercise (the so called 'traditionalists') cite the value of the cadaver experience[22-24]. Those who see the practice as redundant defend their position by pointing to recent technological advancements (the so called 'modernists') [25-27]. At our University cadaver-based learning includes the actual dissection of cadavers by medical students under the supervision of qualified instructors and the study of prosected specimens where individual structures in the human body have been dissected and displayed by skilled dissectors.

It is with this literature review in mind that the research questions addressed in this study are:

- To what extent do medical trainees use their mobile devices?
- What kinds of information are being accessed generally and specifically with reference to anatomical education?

AIM

The purpose of this exploratory study was to establish how learners at a selected medical school use their mobile devices since this was a unique initiative implemented by the College.

MATERIALS AND METHODS

Design

A mixed methodology research design integrating both quantitative and qualitative approaches was chosen to guide our enquiry to generate the data required to meet the aims of this study.

Context and Participants

The study sought to explore how learners at a selected medical school use their mobile devices. The second year class was comprised of a total of 257 medical students registered for the Anatomy course. Of these 179 students (60 male; 119 female) chose to participate in this study (a 69.6 per cent response rate). Teaching sessions are comprised of lectures in various anatomical structural themes (x 5 per annum), for

example, the Cardiovascular System. Each of these themes are presented over an 8-week period comprising approximately 11 one-hour lecture and 29 two-hour practical sessions per theme.

Students were informed about the study and their consent was duly obtained for their voluntary and anonymous participation. Any chance of participant bias was eliminated by clearly explaining the objective of the study while obtaining their informed consent. There were no specific exclusion criteria and no participants withdrew from the study. Ethical approval was obtained from the University Biomedical Research Ethics Committee (BE386/15).

Instrumentation (Appendix A)

A survey questionnaire containing structured and free response items was used in this study to obtain both quantitative and qualitative information regarding student use of their mobile device. Questions 1 and 2 asked all respondents about their prior exposure to mobile devices. Question 3 focused on student knowledge of participation in the College project. Questions 4-9 concentrated on type, frequency and location of usage of the tablets, including the preferred method of learning anatomy. Question 10 covered internet connectivity. Questions 11-13 and 15 asked respondents about their views pertaining to the use of the tablet in accessing anatomical content. Question 14 asked a general question related to applications accessed by students.

Data Analysis

The questionnaire was administered to students before class and they were allocated twenty minutes for completion. The open-ended questions were analysed by two of the authors (LL and RS) using a thematic approach to identify emergent ideas and concepts expressed by participants. Key words, phrases and/or descriptions from the participants were documented, as the authors reflexively engaged with the data. Convergence and divergence of data were noted, leading to the development of preliminary emergent themes. The themes were further interrogated and developed with reference to participants' original words while also including the authors' collective interpretations. The closed-ended questions were statistically analysed using the SPSS version 21.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data for comparison of categorical variables were tested using the Pearson's Chi-squared test (X^2) to compute frequency tables and descriptive statistics. A p value of <0.05 was considered to be statistically significant.

RESULTS

a) Sample demographics

There were 179 respondents with a gender distribution of 60 male and 119 female students and a racial organisation of 137 Black, 26 Indian, 6 White and 9 Coloured participants. Students also indicated their socio-economic backgrounds viz. urban 62, peri-urban 46 and rural 71 (Table 1). The average age of respondents was 20.2 years with a range between 18-28 years.

b) Quantitative results

Significant p-values (highlighted) were recorded for the different categorical variables according to gender, population groups, and socio-economic status (Table 2). The majority of students came from a rural background (39.7 per cent) and these students indicated that they had no prior exposure to a tablet device prior to receiving the current one as part of their course (38 per cent). Statistically significant results were obtained between the sexes ($p<0.020$) when gender was compared to students having prior access to a tablet. Comparisons for the different population groups ($p<0.000$) and socio-economic status ($p<0.000$) also yielded statistically significant results when this parameter was compared to students having prior access to a tablet. The majority (43.6 per cent) of Black students were not aware of the Visual Learning Project and a statistically significant result ($p<0.024$) was obtained when population groups were compared with the level of student awareness of the Visual Learning Project. A total of 35.8 per cent of female students indicated that they used the tablet for both academic and personal reasons compared to 21.2 per cnt of male students. Overall, females tended to access their tablets for anatomy- related content more often when compared to their male counterparts (Table 2) which yielded a statistically significant p value ($p<0.017$). A total of 37.4 per cent of students from rural backgrounds used the tablet to access lecture notes and a statistically significant value of $p<0.000$ was obtained when socio-economic status was compared with the latter parameter. A total of 24 per cent of male students reported that they found physical dissection more beneficial in the study of anatomy as opposed to female students who preferred visual aids (15.1 per cent). A total of 62 per cent of female students reported that they accessed the tablets for lecture notes; these students also indicated that they accessed their tablets whilst on campus (36.3 per cent). However, 17.4 per cent of African students reported a lack of internet access at home ($p<0.000$ when population groups were correlated with internet availability). A total of 43 per cent of female students indicated that the tablet made accessing anatomy-related content more convenient for them. A majority of female students (33.5 per cent) reported that they found access to anatomy-related study material i.e. lecture notes via the tablet beneficial to them versus 29.6 per cent of male students who accessed the tablet for a similar purpose. Despite having

the tablet, female students still recorded lecture notes during classroom time (43.6 per cent). Statistically significant correlates were recorded for gender ($p<0.032$) and population groups ($p<0.014$) versus traditional note taking. A total of 83.8 per cent of students indicated that provision of the tablet did not affect their attendance (57.5 per cent female and 26.3 per cent male) (Table 2).

c) Qualitative results

The following themes emerged from the data:

i. Mobile device engagement

Learners listed a number of uses in their engagement with mobile devices. These uses have been categorised and on inductive analyses, were aligned with Ellaway's (2014)[13] four activity groups as outlined in the Introduction of this paper (Table 3) as follows:

- *Logistics:* Students reported the use of the tablet to access emails (16.2 per cent) and browse the web (77 per cent) using internet sites such as Firefox and Google;
- *Personal:* Students also accessed social media such as Facebook (1.7 per cent), social videos (8.4 per cent) and games (7.3 per cent);
- *Learning tools:* A large majority of the students accessed the tablet for lecture notes (91.6 per cent) whilst 26.3 per cent of learners used applications such as WPS Office to alter documents; and
- *Learning content:* Students also accessed sites for drug guidelines such as Medscapes (1.7 per cent) and 6.2 per cent accessed Anatomy e-books such as Netter's Interactive, Drake's Grey's Anatomy and software applications such as Essential Anatomy 2 and Visual Anatomy for learning content and expressed the view that they learnt better by watching anatomy videos on the tablet as anatomical specimens are clearer in the videos and this enabled them to understand the content.

Students also mentioned that the tablet allowed them to learn at their own pace (21.2 per cent).

"The visual part, the one I use with the tablet enables me to combine what I learn in the class with what I see and it makes me able to know the exact locations of certain important structures."
(Participant 1; male) (Count =31)

ii. Advantages of mobile devices

Participants listed a number of advantages associated with the use of mobile tablets such as portability (6.7 per cent) allowing students the opportunity of accessing information on campus and allowing them to revise at home, access to information on the internet (22.9 per cent) and research areas of course content that were not covered in the lectures (9.5 per cent).

"With visual aids, I can access the slides and videos anytime" (Participant 33; female) (Count=63)

Respondents also mentioned the value of utilising dissection as well as visual aids in the learning of anatomy (17.3 per cent).

"Tablet enables one to combine what is learnt in lectures with structures in the DH"(Participant 21; female) (Count=6)

iii. Challenges affecting use of mobile devices

Respondents reported on some of the challenges they experienced with the use of the tablet such as having no Wi-Fi access outside of campus (64.2%)as well as poor Wi-Fi access on campus (12.3%). m

"I do not have access to the internet at home" (Participant 4; female) (Count=122)

Some also considered that learning from the tablet did not improve their understanding of anatomy (3.4 per cent) and felt that learning from the cadaver was easier (60.3 per cent) as opposed to the tablet.

"The tablet does not provide visual aids of real specimens, just lecture slides. Looking at real specimens helps orientate oneself and get a three dimensional understanding." (Participant 70; female) (Count=103)

Respondents also reported on the lack of anatomy-related content being posted on the university website (3.4 per cent).

"There are no resources for Anatomy in the UKZN Tube."(Participant 2; male) (Count=4)

iv. Miscellaneous use

Participants also used their devices for private use such as a camera (3.4 per cent) and as a media player (6.1 per cent). Some respondents stated that the tablet has no effect on their leaning at all (11.2 per cent).

DISCUSSION

In conducting this exploratory investigation into student perceptions of Tablet usage, it was found that there are many issues to consider when using this technology in practice. The results from this study reveal that students are using mobile devices for both academic as well as private purposes outside of the classroom. According to Yau and Leung (2016)[28], gender differences account for one of the factors affecting students' use of technology. In this study, females were inclined to use their tablets more often than males, which was statistically significant (Question 5, Table 2). These results concur with those reported by Yau and Leung (2016)[28] but differ from Kekkonen-Moneta and Moneta (2002)[29]; the latter authors suggested that tablet technology use is a more dominant activity for male students. McNulty (2006)[30] and (2009)[31]demonstrated that although students may be familiar with Web-based educational resources, medical student usage of Web-based computer-aided instruction is related to gender, learning styles and personality.

The majority of students (91.6 per cent) accessed their tablets for lecture notes. These lectures define a range of content available for Web access, ranging from text files to audio or video-enhanced presentations to captured video lectures. According to Chan and Pawlina (2015)[32], lecture-capture records an instructor's presentation as it is delivered live in the classroom, as is the scenario at our university. Lecture-capture is regarded as an effective review tool for students provided that the lecture is well presented. More than any previous mobile learning technology, tablets provide students with immediate and far-reaching access to information, course resources and real world application of knowledge[12].

The educational practice of technology can be associated with learning theories[33]. The various uses of mobile learning can be associated with the different stages in Kolb's learning cycle[34]. For example, accessing the tablet for related lecture notes in the dissecting hall provides an opportunity to practice skills, social media (such as YouTube videos and Wikipedia) can assist in maintaining learners' reflections on experiences and 'apps' can offer access to knowledge which can assist abstract conceptualization[33].

Bullock and Webb (2015)[33] further cite the impact of technology on Eraut's theory of informal learning in the work-place as being either implicit, reactive or deliberative. In this study, the so-called work-place refers to the University environment. Learning from social media is regarded as being implicit learning; reactive learning is opportunistic, often occurring in the middle of an action such as accessing the tablet "to view content and determine anatomical positions realistically *(Participant 3; female)*." Deliberate learning is regarded as having a goal and a set time (Eraut, 2004)[35] where the learner clearly thinks about their actions such as accessing lecture notes for study purposes. Students reported that the immediate access to

information enhanced in-class understanding of content *("….the tablet enables me to combine what I learn in the class with what I see and it makes me able to know the exact locations of certain important structures*").

The qualitative data in this study corroborates the views expressed by Rossing et al., (2012)[12] particularly student responses in the themes of mobile device engagement and advantages of mobile devices.

The growing number of websites and databases further facilitate the ease with which students can "*download certain books and videos using my tablet and so it has made accessing anatomy-related content more convenient*." Some students were motivated enough to access additional anatomical content via web-based learning such as E-books, Drug Guides, Essential Anatomy 2, Visual Anatomy supporting the deliberative aspect of informal learning.

Hafferty (1998)[36] defines the informal mobile curriculum as those practices that "target[s] learning at the level of interpersonal interactions." Such interpersonal interactions can be found in modern anatomy curricula in learning spaces such as anatomy laboratories where students access their tablets. The deliberate engagement with the tablets in this setting allows students to access notes, videos, e-books and software applications which provide interactive visual information to augment their learning. The touch screen capabilities of the tablet allows students to enlarge or rotate images with ease, thereby making learning more hands on[10 37]. Further, they provide visual representations of anatomy that more closely resemble the structures in the human body[7]. This is especially beneficial in those programmes in the field of health sciences that do not possess anatomy laboratories as a component of their curriculum; hence anatomy applications may be a useful resource for augmenting student learning.

This study's findings ("…since the tablet is portable, I am able to view lecture slides more frequently") support the literature that recommends that today's students desire and benefit from 'anywhere, anytime' learner participation[4]. The literature suggests that mobile learners desire the ability and flexibility to choose their location and time for learning[4 12]. As reported by this study, learners were allocated their own tablets; therefore they had the option of using it for personal purposes; thus supporting Ellaway's (2014)[13] logistical category of mobile device activity. Students largely accessed their tablets on campus as they experienced problems accessing wireless connectivity at home. The Failure of Wi-Ficonnectivity leads to disenchantment with mobile devices *("…there is no Wi-Fi")* and severely hampers the learning process.

Some learners also felt that physical dissection provided the best method of learning anatomy (30.9 per cent), corroborating the views of authors such as McLachlan et al., (2004)[38] and McLachlan and Patten

(2006)[39]despite the implementation of the newer technology; whilst some students felt that the provision of the tablet had no effect at all on their learning (6.7 per cent).

In order to maximise the benefit of mobile tablets, educators must carefully adapt the technology to specific learning goals and outcomes. Educators must not assume that students are prepared for new technologies and need to gauge student's level of knowledge and comfort with new technological devices. It is essential to devote classroom time to students to acclimate to these new devices.

CONCLUSION

Mobile computing devices have been rapidly adopted by medical learners worldwide, including those at our university as illustrated by this pilot study and it seems likely that their presence will soon be ubiquitous. This study offers a unique South African perspective which has the possibility to enhance learning, but it also points out potential problems associated with its use. We can conclude from our study that integrating tablets into Higher Education anatomy classes had a positive effect on student access to course material. In a subject already utilising active learning through traditional methods the addition of technology via quizzes, 3D visual material and access to the internet could be an alternative method of engaging students in the learning process. Students are seizing opportunities of learning anywhere, anytime due to the portability of their mobile devices.

Limitations and implications for future research

Firstly, this study is limited by the exclusive use of the Proline 7"android tablet. Additional research is necessary to incorporate the use of other branded technological devices such as the Apple iPad.

Secondly, as this study used purposive sampling, the results may be limited by the nature of the population and cannot be generalised to account for student experiences with other academic courses offered. Additional research is necessary to isolate disciplinary strengths and weaknesses.

Thirdly, students in graduate programmes such as those registered for medical degrees are expected to be self-directed learners who have the ability to locate resources to supplement their learning. This could be a motivating factor for students to use their tablets for learning outside of the classroom. Further studies are necessary to determine whether or not mobile devices such as the tablet have an impact on academic performance, assessments and whether or not they encourage self-directed learning. Additional studies are warranted to determine the effect of tablet technology on examination performance.

Fourthly, there should be no compromise in students having access to the material they are promised; university administrators should ensure that provision is made for technological support in places such as living residences that should have Wi-Fi access points for students to utilise at their convenience. As mobile technology continues to grow and develop, universities cannot be caught with a wireless infrastructure incapable of handling the demand for connectivity.

TABLES

Table 1: Demographic profile of the study respondents (n=179)

Parameter	Frequency (%)
Gender	
Male	60 (33.5)
Female	119 (66.5)
Population Groups	
Black	138 (77.1)
Indian	26 (14.5)
White	6 (3.4)
Coloured	9 (5.0)
Socio-economic status	
Urban	62 (34.6)
Peri-urban	46 (25.7)
Rural	71 (39.7)

Table 2: Responses to closed-ended questions according to gender, population groups and socio-economic status

*Question		Incidence of Demographic factor (%)									
		Gender		Population Groups				Socio-economic status			
		Male	Female	Black	Indian	White	Coloured	No Comment	Urban	Peri-urban	Rural
2. Did you have access to a tablet prior to receiving the current one?	No Comment	0.6	0	0.6	0	0	0	0	0	0.6	0
	Yes	4.5	20.1	9.5	9.5	2.8	2.8	0	17.9	2.8	3.9
	No	28.5	46.4	66.5	5.0	0.6	2.2	0.6	16.8	22.3	38.0
P Value		**0.020**		**0.000**				**0.000**			
3. Were you familiar with the visual learning programme prior to the provision of the tablet?	No Comment	0.6	1.1	1.8	0	0	0	0	0	0.6	1.1
	Yes	14.5	33.5	31.3	11.7	1.8	2.8	0.6	21.8	10.1	15.6
	No	18.4	31.8	43.6	2.8	1.8	2.2	0	12.8	15.1	22.3
P Value		0.665		**0.024**				0.096			
4. What do you frequently use the tablet for?	No comment	0	1.1	1.1	0	0	0	0	0	0.6	0.6
	Academic	10.6	26.8	29.1	6.1	0.6	1.7	0	13.4	8.4	15.6
	Personal	1.1	2.8	2.2	1.1	0.6	0	0	1.7	1.7	0.6
	Academic & Personal	21.2	35.8	44.1	6.7	2.2	3.4	0.6	19.6	14.5	22.3
	Other	0.6	0	0	0.6	0	0	0	0	0.6	0
P Value		0.342		0.425				0.835			
5. How often do you use the tablet to access anatomy-related content?	No Comment	0.6	0.6	1.1	0	0	0	0	0	0	1.1
	Everyday	6.1	15.6	18.4	1.1	0.6	1.1	0.6	8.4	4.5	8.4
	Twice a week	7.8	16.8	17.3	4.5	1.1	1.7	0	10.1	6.1	8.4
	More than 3 times week	11.7	8.9	17.9	2.2	0	0.6	0	2.8	7.3	10.6
	Once in two weeks	2.2	3.9	4.5	1.1	0	0.6	0	2.2	2.8	1.1
	Other	5.0	20.7	17.3	5.6	1.7	1.1	0	11.2	5.0	9.5
P Value		**0.017**		0.728				0.164			
6. Which of the following do you most frequently access via your tablet?	No Comment	1.1	1.1	1.1	1.1	0	0	0	1.1	1.1	0
	Lecture notes	29.6	62.0	71.5	11.7	3.4	4.5	0	30.7	23.5	37.4
	Actual lecture	1.7	1.7	2.2	1.1	0	0	0.6	1.7	1.1	0
	Demo & Practical	1.1	1.7	1.7	0.6	0	0.6	0	1.1	0	1.7
P Value		0.701		0.412				**0.000**			
7. Which method of studying anatomy do you find most beneficial to you?	No effect	2.2	4.5	0.6	0.6	1.1	0.6	0	2.8	1.7	2.2
	Visual aid	6.7	15.1	3.4	0	0	2.8	0.6	8.9	5.6	6.7
	Physical dissection	24.0	6.9	10.6	2.2	3.9	1	0	22.9	18.4	29.6
P Value		0.938		0.212				0.491			
9. Where do you generally use your tablet?	On Campus	24.6	36.3	60.0	5.6	0	2.8	0.6	15.6	18.4	26.3
	Home	7.8	27.4	21.2	8.9	3.4	1.7	0	17.3	6.7	11.2
	Hospital	0	1.1	0.6	0	0	0	0	0	0.6	0
	Campus & Home	1.1	2.2	2.8	0	0	0.6	0	1.7	0	1.7
P Value		0.093		**0.004**				0.082			
10. Do you have internet access at home?	Yes	5.6	33.5	6.1	12.3	3.4	3.4	0	19.6	3.4	2.2
	No	27.9	19.6	17.4	2.2	0	1.8	0.6	15.1	22.3	36.9
P Value		0.064		**0.000**				**0.000**			
11. Has the tablet made accessing anatomy-related content more convenient for you?	No Comment	1.1	5.6	5.6	0.6	0	0.6	0	2.2	2.8	1.7
	Yes	24.6	43.0	51.4	8.9	2.2	4.5	0.6	25.1	16.2	25.7
	No	7.8	17.9	19.6	5.0	1.1	0	0	7.3	6.7	11.7
P Value		0.339		0.540				0.712			

12. What do you consider most beneficial to you?	**No Comment**	3.4	5.6	6.7	1.7	0.6	0	0	2.8	1.1	5.0
	A : Live streaming of lectures and practical's only	1.1	0.6	1.7	0	0	0	0.6	0	0.6	0.6
	B : Physical attendance at lectures and practical's only	0.6	1.1	1.1	0.6	0	0	0	0	0.6	1.1
	C : Live streaming of lectures AND physical attendance at lectures and practical's	11.7	19.6	27.9	2.8	0	0.6	0	10.1	10.1	11.2
	D : Access of anatomy-related study material only, i.e. lecture notes	1.1	1.1	1.7	0.6	0	0	0	1.1	0.6	0.6
	E : Live streaming of lectures AND access to anatomy-related study material, i.e. lecture notes	2.8	5.0	3.4	2.8	0.6	1.1	0	5.6	1.1	1.1
	F: Physical attendance at lectures and practical's AND access to anatomy-related study material i.e. lecture notes	12.8	33.5	34.1	6.1	2.2	3.4	0	15.1	11.7	19.6
P Value		0.708		0.320				**0.000**			
13. In addition to the provision of the tablet, do you still record notes during the lecture?	**No Comment**	1.7	0.6	1.7	0.6	0	0	0	1.1	0	1.1
	Yes	16.2	43.6	14.2	12.8	2.8	3.9	0	25.1	14.5	20.1
	No	15.6	22.3	34.6	1.1	0.6	1.1	0.6	8.4	11.2	17.9
P Value		**0.032**		**0.014**				0.116			
15. Does the provision of the tablet affect your attendance at lectures and practical's?	**No Comment**	4.5	2.8	4.5	2.2	0.6	0	0	3.4	1.7	2.2
	Yes	2.8	5.6	7.3	0.6	0	0.6	0	2.2	3.4	2.8
	No	26.3	57.5	64.2	11.7	2.8	4.5	0.6	28.5	20.7	34.1
P Value		0.144		0.752				0.867			

***Questions numbered according to Questionnaire (Appendix A)**

Table 3: User-engagement of learners with tablets by gender groups (n=179)

Activity Group	Male (%)	Female (%)	Total (%)
Logistical			
• Email	5.0	11.2	16.2
• Web-browsing	26.2	50.8	77
• Time-keeping	0.6	-	0.6
Personal			
• Social Media	0.6	1.1	1.7
• Social Videos	3.4	5.0	8.4
• Gaming	1.7	5.6	7.3
Learning Tools			
• Accessing notes	29.6	62.0	91.6
• Alteration of Documents	10.1	16.2	26.3
Learning content			
• Drug guides	1.1	0.6	1.7
• Anatomy E-books& software applications	1.7	4.5	6.2

Contributors

All three authors are suitably credited with authorship, according to the authorship criteria. In detail: LL collection, analysis and interpretation of data, drafting the article and final approval of the version to be published. RS: analysis and thematic development, revising the article and final approval of the version to be published. KSS: revising the article and final approval of the version to be published.

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Competing Interests

We have read and understood BMJ policy on the declaration of interests and declare that we have no competing interests.

Ethical approval

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Data-Sharing statement

No additional data are available.

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APPENDIX
TABLET TECHNOLOGY IN MEDICAL EDUCATION

The purpose of this survey is to provide faculty with information about whether you utilise mobile devices as they relate to your studies in the Anatomy Programme. This survey is for general programme development and is voluntary. However, your participation is greatly appreciated and will be useful in course planning, development and improvement. Please mark with a tick where appropriate

Age: _____

Sex:	**M**	**F**

Population Group:	**Black African**	**White**	**Indian**	**Coloured**

Socio-Economic Background	**Urban**	**Peri-urban**	**Rural**

1. When did you receive your tablet? _____

2. Did you have access to a tablet prior to receiving the current one?

Yes
No

3. Were you familiar with the visual learning programme prior to the provision of the tablet?

Yes
No

4. What do you most frequently use the tablet for? (Please cross the most applicable option)

Academic
Personal
Academic and personal
Other

5. How often do you use the tablet to access anatomy-related content? (Please cross the most applicable option)

Everyday
Twice a week
More than three times a week
Once in two weeks
Other

6. Which of the following do you most frequently access via your tablet? (Please cross the most applicable option)

Lecture notes
The actual lecture
Demonstration of prosected specimens

7. Which method of studying anatomy do you find most beneficial to you? (Please cross the most applicable option)

Visual aid (learning via the tablet)
Physical dissection and viewing of prosected specimens

7.1 Please explain your preferred choice:

_____
_____

8. How does the use of the tablet for the access of anatomy-related content assist with your clinical skills?

_____
_____

9. Where do you generally use your tablet? (Please cross the most applicable option)

At campus
At home

At hospital during ward rounds

9.1 Please explain the reason for the selected location?

_____
_____

10. Do you have internet access at home?

Yes
No

10.1 How does this affect the usage of your tablet to access anatomy-related content?

_____
_____

11. Has the tablet made accessing anatomy-related content more convenient for you?

Yes
No

11.1 Please elaborate about your choice

_____
_____

12. What do you consider most beneficial to you? (Please cross the most applicable option)

Live streaming of lectures and practical's only
Physical attendance at lectures and practical's only
Live streaming of lectures AND physical attendance at lectures and practical's
Access to anatomy-related study material only, i.e. lecture notes
Live streaming of lectures AND access to anatomy-related study material, i.e. lecture notes
Physical attendance at lectures and practical's AND access to anatomy-related study material, i.e. lecture notes

13. In addition to the provision of the tablet, do you still record notes during the lecture?

Yes
No

14. What applications do you most frequently use on your tablet? (Please list in order of preference)

1. _____
2. _____
3. _____

15. Does the provision of the tablet affect your attendance at lectures and practical's?

Yes
No

CHAPTER 5

SYNTHESIS, CONCLUSIONS & RECOMMENDATIONS

5.1 Synthesis

In compiling this thesis, two aspects of the study of human anatomy, viz. research and praxis from studies conducted by the author form the focal moments in this compendium. These two aspects use autoethnography as common methodological stances in varying degrees across the manuscripts. In all of these manuscripts I demonstrate a pedagogical 'embeddedness' as a direct participant, researcher, educator and reviewer in the field of human anatomy.

In this chapter each of these manuscripts are summarily examined, highlighting the commonalities that emerged from the two areas of research. I will also describe my findings in the light of teaching and learning theories drawn from the broad field of education as well as the literature on human anatomy teaching and learning. This discussion draws attention to significant insights that have been derived from the data and these are presented using a conceptual framework. Further, the nexus between research and praxis is demonstrated within the domain of educational theory.

5.2 Summary moments

In summarising all five manuscripts, the core thematic patterns captured in the diagrams below, contribute to the emerging insights of the thesis (Figures 1-5).

Figure 1: Relationship between self and challenges experienced at my University

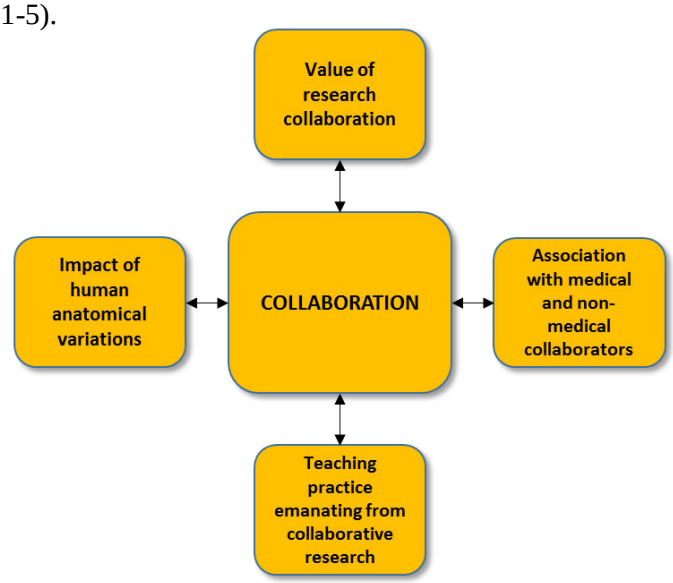
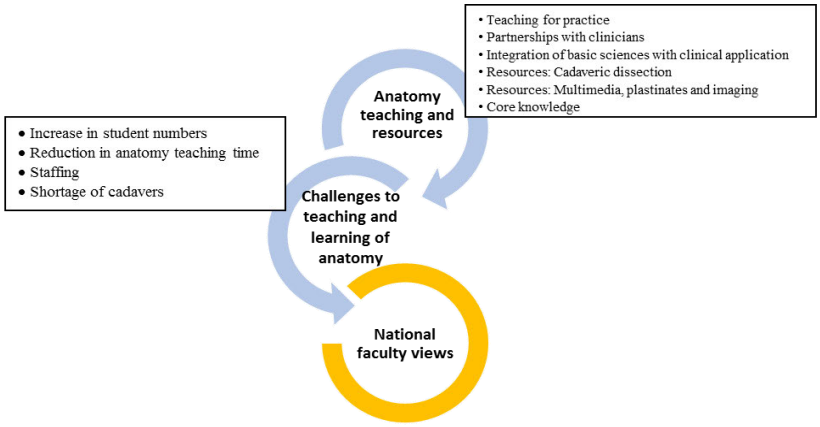


Figure 2: Effect of collaboration with nodal informers

Bits, bytes and bones: An autoethnographic account of challenges in anatomy education: Perceptions emanating from a selected South African university

Communities of practice: a new methodology in anatomical research and teaching



Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education

Figure 3 : Factors affecting teaching and learning of Anatomy in South Africa

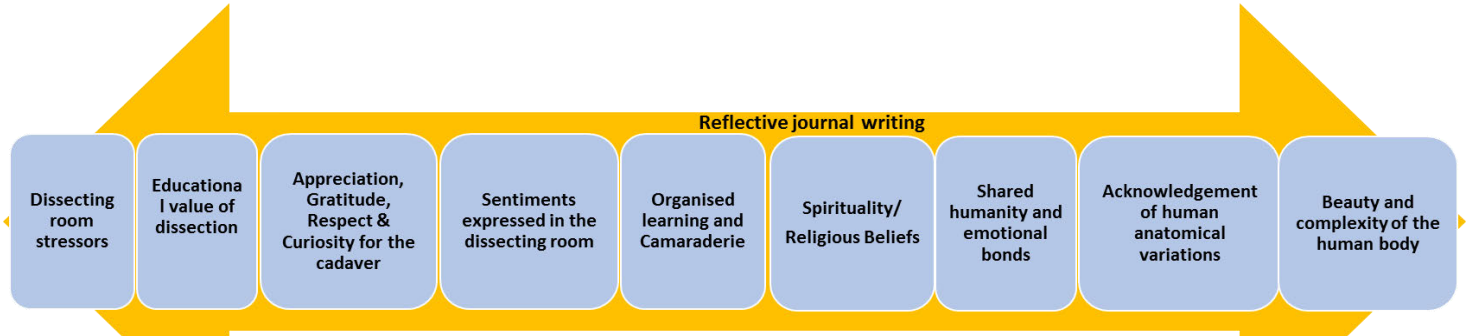
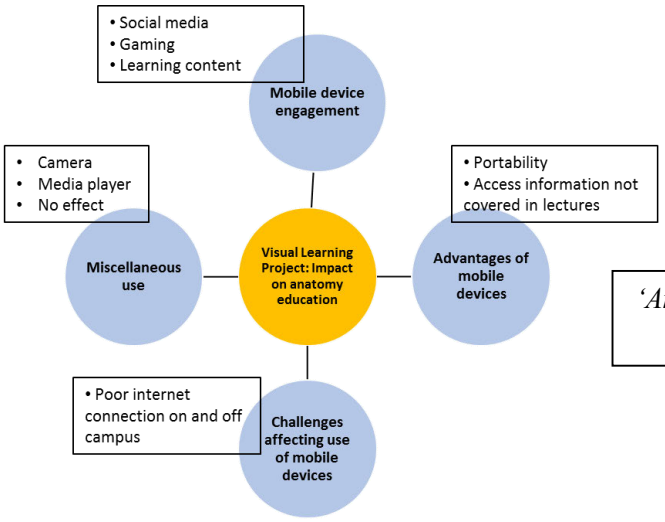


Figure 4: Student perspectives of experiences with cadaveric dissection via reflective journaling

Reflective journals: unmasking student perceptions of anatomical education



'Anytime, Anywhere': Tablet Technology in Medical Education

Figure 5: Effect of m-learning on anatomy education following implementation of Visual Learning Project at the University of KwaZulu Natal

Key for Figures 1-5

	The orange colour depicts the thread of autoethnography running through the thesis and the extent of engagement from the researcher
	Praxis (Teaching and learning) of human anatomy: partial engagement of researcher as educator
	The use of specific and relevant Educational Theory
	Manuscript title
- - →	Relationship between manuscripts and educational theory

As illustrated in all five manuscripts, the discipline of Clinical Anatomy is fraught with teaching, learning and research challenges, as highlighted through the use of an innovative autoethnographic stance (Figure 1). These challenges also resonate internationally within the anatomical fraternity as reported by Turney (2007) and Rizzolo and Drake (2008). Through collaborative autoethnography (Figure 2), voice, experience and theory become mutually entwined in an investigation which embodies the essence of scientist-clinician partnerships to promote and sustain interdisciplinary research in a changing landscape, concurring with Sugand et al. (2010), Bergman et al. (2014) and Yammine (2014). A foundational knowledge of anatomy is essential and learning objectives should be the same across Universities irrespective of whatever teaching approaches are adopted within a curriculum (Figure 3), echoing the sentiments expressed by Chapius et al. (2010), Bergman et al. (2011) and Berman (2014). In summary, this study highlights a clear need for research that addresses not just the learning of anatomy, but also advocates the need for anatomical research and praxis requirements of cutting edge clinical practice. Data emerging from this study offer essential information (Figure 4) on promoting reflection regarding anatomy and health care, examining the student-cadaver relationship, probing questions about spirituality and religion and exploring the emotional responses to dissection, concurring with the views of Shaprio et al. (2006).

The introduction of integrative journal writing creative projects into the anatomy course is innovative and provided critical reflections through the use of student voices. In addition, by integrating mobile devices into higher education anatomy classes, the teaching and learning of anatomy was enhanced as students utilized active learning approaches as an alternative method of engaging with the discipline. Such positive effects of mobile learning, as exhibited in this study, corroborates those of Perez et al. (2011), Mang and Wardley (2012) and Rossing et al., (2012).

5.3 The epistemological glance

Four leaning theories are used to underpin this manuscript and these include the co-creation of knowledge, community of practice, teaching and learning in context and learning informally.

5.3.1 Co-creation of knowledge

The concept of the co-creation of knowledge is borrowed from the educational theory of social constructivism which proposes that "human development is socially situated and knowledge is constructed through interaction with others" (McKinley, 2015; p. 184).

In this thesis, the theory of social constructivism was used in the following manuscripts: *Bits, bytes and bones: An autoethnographic account of challenges in anatomy education: Perceptions emanating from*

a selected South African university; and *Reflective journals: unmasking student perceptions of anatomical education* (Figure 6). In the next section I use the autoethnographic lens to view how the broad generalisations based on the insights and findings from this manuscript inform theoretical analysis.

In this autoethnography, I address the self (auto), research and praxis of human anatomy (ethnos), and the writing and research process (graphy), (Reed-Danahay, 1997), recognising that I am "both the researcher and the researched" (Muncey, 2010). I have taken a social constructivist approach where the practice of autoethnography presumes that reality is socially created (Ellingson and Ellis, 2008) and where I, as the autoethnographer, can contribute to the social production of what is known in the research and praxis of human anatomy.

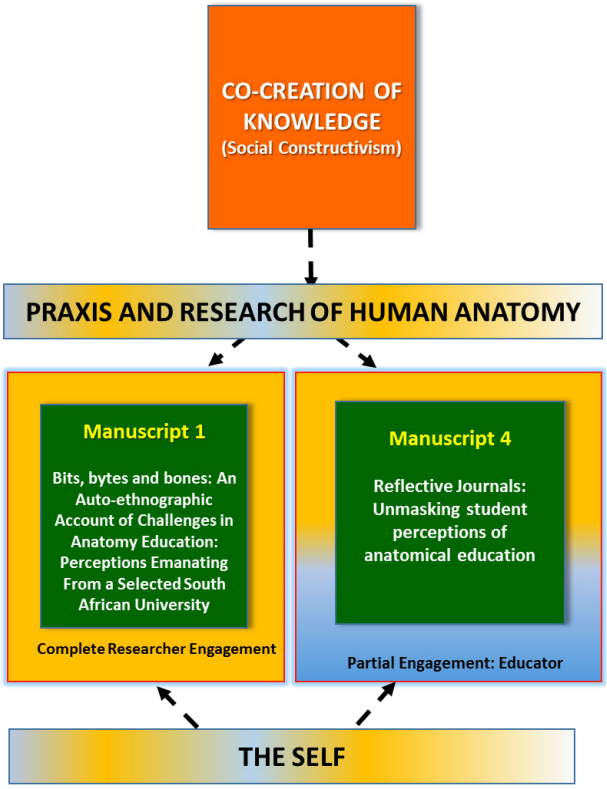


Figure 6: Application of co-creation of knowledge

The findings of this study were established by reporting the researcher experience as opposed to being the subject with regard to the epistemological processes of generating knowledge. I was able to use Chang's (2008) writing exercises to increase my engagement with the reflexive processes. The methodology of autoethnography assisted me in unravelling my story of how I developed into an anatomy educator and to evaluate the foundation of my knowledge creation. Therefore, my autoethnographic narrative is not just about me but is a contextual account of my practices in relation to the historical, technological and cultural experiences of the time, all of which have shaped my identity, and will continue to do so.

In this study. the gross anatomy laboratory provided an ideal setting for small group interactions between students themselves and faculty and students, concurring with Drake (1998), Miller et al., (2002) and McLachlan and Patten (2006) who suggested that these interactions provide invaluable opportunities for active learning and reflection on anatomical knowledge. This study highlights the fact that by facilitating collaboration among peers, aspects of the discipline, such as an appreciation of anatomical variations and the experience of differential observations can be supported and enriched by allowing students to share and benefit from each other. Such interactions with students and faculty promote a mutual learning style that assists to develop a healthy and profound understanding of the

subject. This study also reports that the gross anatomy laboratory is also a setting where students experience emotional responses to difficult or disturbing clinical situations, corroborating the sentiments expressed by Chan (2015). The laboratory also provided a site where students could deal appropriately with these emotions caused by such exposure concurring with authors such as Rizzolo (2002) and Stewart and Charon, 2002).As illustrated in this study, small group engagement in the laboratory promotes a co-creation of knowledge by encouraging co-operative learning and stimulating reciprocal teaching among peers.

The gross anatomy laboratory allows students to assimilate, accommodate and interpret information. Students are faced with scenarios that provoke reflection, dialogue and conceptual reasoning which leads to the creation and recreation of student anatomical knowledge. By reflecting on their experiences, students demonstrate conceptual understanding. Additionally, exposure to the cadaver and the emotions that this experience evokes provides a context that some students can perceive as being personally meaningful to them.

5.3.2 Collaborative research in human anatomy

Sullivan (1998) reports that collaboration is a dynamic process between partners to address needs and problems to reach desired outcomes or a common purpose successfully through well-functioning communication (Winge et al., 2005). Crist and Escandon-Dominguez (2003) stated that collaboration creates a sense of shared autonomy between partnerships to achieve mutually identified goals that would otherwise not be possible.

"Communities of practice" consist of members who interact with each other for their pursuit of a common practice (Wenger, 1998; p.7). It is therefore this collective social practice that links individuals together across boundaries and departments and makes up the community.

In the manuscript entitled *Communities of practice: a new methodology in anatomical research and teaching,* autoethnography via narrative story-telling functions as a wisdom repository and is instrumental in the creation of new knowledge (Sole and Wilson, 2002). Vygotsky's (1978: p.131)

model of the zone of proximal development which proposes that "the distance between the [learner's] actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under (adult guidance) or in collaboration with more capable peers" can be applied to the above manuscript where the learner is the "self" and the knowledgeable experts refer to the nodal informers identified in this thesis. Communities of practice need not be limited to one department or school if there is sufficient commonality between disciplines (Scott et al., 2014). Collaboration between myself and clinical colleagues resulted in engagement of joint activities and discussions so that we could assist each other and share information. Relationships were formed that assisted us to learn from each other. Prawat and Floden (1994) proposed that knowledge creation is not an individual experience, but a shared one and knowledge is generated through working within collaborative discourse communities. This latter proposal can be applied to the manuscript on *Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education* where the communities of practice can exist independent of the prevalent research and teaching mechanisms of the institution. Thus, communities of practice can be extrapolated to incorporate national faculty adding richness to the community as a whole.

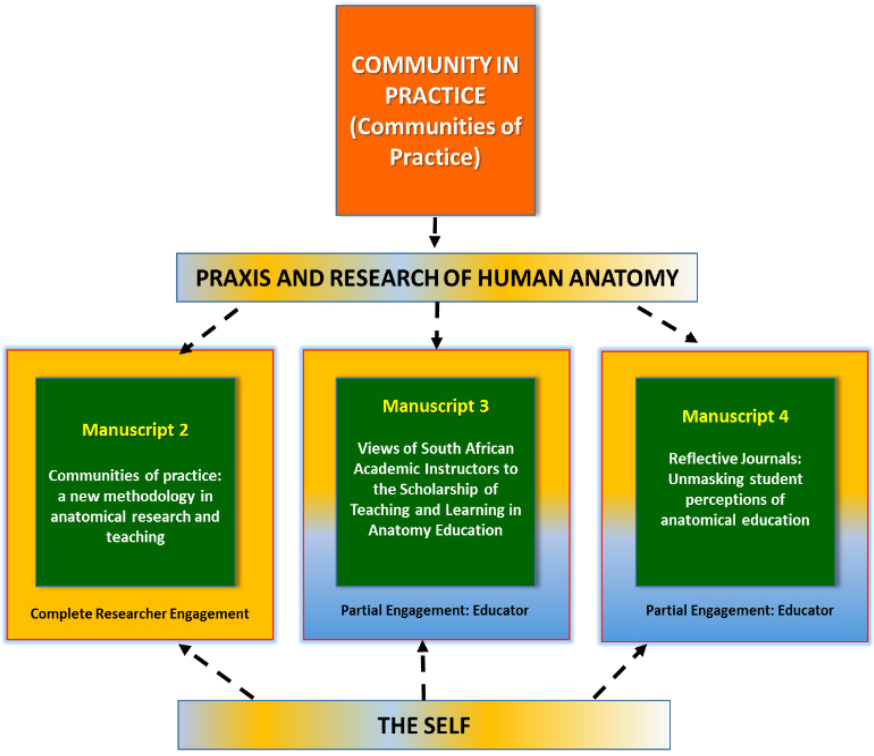


Figure 7: Application of community in practice

Students readily form small communities of practice in learning on their own as seen in the gross anatomy laboratory and echoed in the manuscript entitled *Reflective Journals: Unmasking student perceptions of anatomical education.* Collaboration is essential to allow students to exceed their current levels of understanding and to encourage metacognition. Small learning groups participating in cadaveric dissection exemplifies a communal learning experience.

5.3.3 Teaching and learning in context (praxis)

It is proposed that teaching and learning in context is underpinned by the educational theory of situated learning in this study. Situated learning theory hypothesises that 'everyday' unconscious learning occurs by reference to activity, context and the culture in which it takes place or is situated (Lave and Wenger, 1991; McHarg and Kay, 2008), and can be used to provide insights into the three manuscripts described in Figure8.

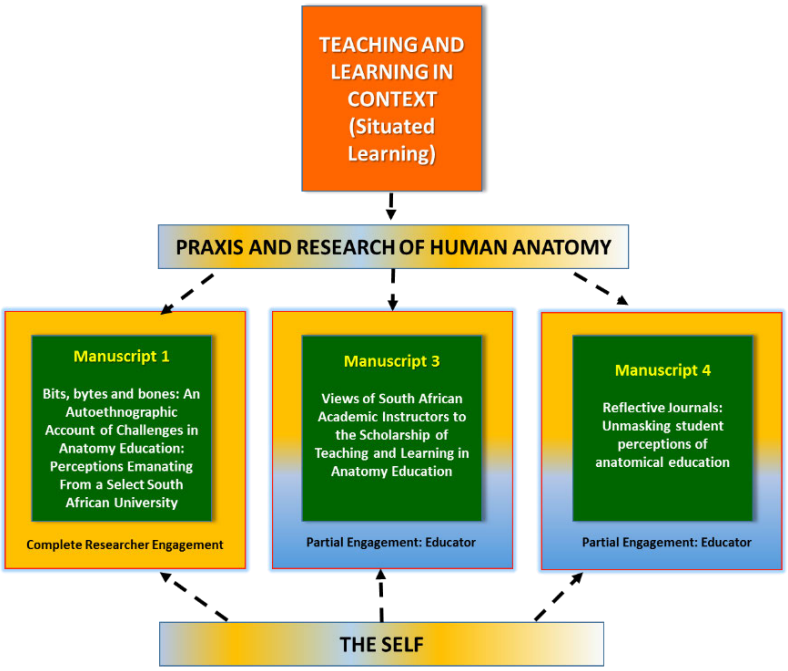


Figure 8: Application of teaching and learning in context

The situated culture highlighted in the manuscript on "*Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating from a selected South African University*" demonstrates the challenges experienced as an anatomy educator within a selected discipline at a higher education institution in South Africa. In this study, autoethnography promoted a state of mindful awareness of the self as both inquirer and respondent, as teacher and learner in the research and praxis of human anatomy. It is through this lens that I sought to examine the complex processes of situated learning of practice through episodic reflection captured in narrative writing.

The situated culture referred to in the manuscript entitled *Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education* refers to the teaching and learning of human anatomy at various medical schools in South Africa. The perceptions gleaned from this component of the thesis highlight anatomists' cultural journeys with regard to knowledge, skills and attitudes within their discipline. Socialisation into the anatomy profession occurs via the co-creation of knowledge with several different experts. Hence, this study explored the views of the anatomists with more than twenty years of experience.

This study concurs with Wessels et al. (2015) who stated that learning in a gross anatomy laboratory can be a function of the various learning activities within a specific community that related to the subject matter. In this study, students found that they were able to develop an understanding of the three dimensional nature of structures by performing dissection. These sentiments are highlighted in the manuscript entitled *Reflective Journals: Unmasking student perceptions of anatomical education*. Participation with fellow students extended the teaching and learning process in the laboratory and for

myself as the educator. By applying teaching and learning in context laboratory, learning experiences that facilitated knowledge transfer by authentic tasks, learning experiences that created personal meaning and learning experiences that encouraged social interaction among learners, teachers, and the environment was promoted.

5.3.4 Learning informally

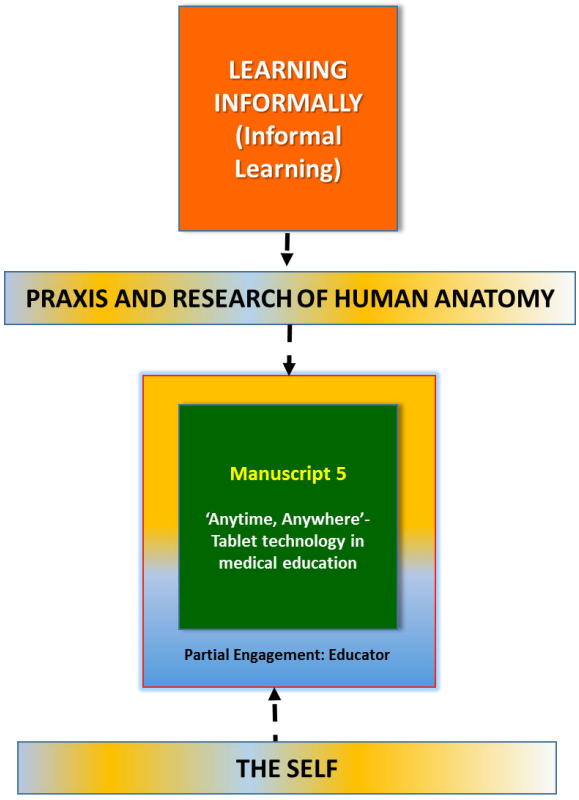


Figure 9: Application of learning informally

Learning informally in this thesis is underpinned by the educational theory of informal learning. Informal learning is typically defined as a broad term that describes learning which takes place outside the classroom (Berth, 2006). Bullock and Webb (2015) cite the impact of technology on Eraut's (2004) theory of informal learning in the work-place as being either implicit, reactive or deliberative. In this study, the so-called work-place refers to the University environment. In this study, learning from social media was regarded as being implicit learning; reactive learning was opportunistic which often occurred in the middle of an action such as accessing the tablet in the gross anatomy laboratory "to view content and determine anatomical positions realistically" *(Participant 3; female)*. Deliberate learning occurred when the learner clearly thought about his/her actions such as accessing lecture notes for study purposes. Students reported that the immediate access to information enhanced in-class understanding of content, concurring with that reported by Nguyen et al., (2014).

5.3.5 Conceptual framework for research and praxis of human anatomy

I consider a conceptual framework as an overall worldview. It is an individual perspective defined not only by values and perceptions (Northcutt and McCoy, 2004), but also by the sum of one's experiences, beliefs, and knowledge from every facet of life, including, for example, gender, religion, family, politics, society, and the academic, and environmental milieu. Brink (2006) states that a framework of a research study assists the researcher to organise the study and it provides a context in which he or she examines a problem and gathers and analyses data, through identifying and outlining concepts and

proposing relationships between these concepts. The researcher is then able to illustrate that the study under investigation is a logical extension of current knowledge by developing the framework within which ideas are structured (Scrooby, 2012).

Learning is an active process of creating meaning and transforming understandings in interaction with the environment (Gravett, 2005). Gravett (2005) further emphasises that meaning is arrived at through creating relationships between information and facts and one's existing knowledge, results in coherent knowledge structures. The building of an integrated conceptual framework (connected knowledge) results in learning that is meaningful. When learning (the creation of meaning) occurs, students and faculty actively connect new information or ideas to their existing knowledge.

Garrison and Archer (2000) state that students can best create meaningful personal knowledge when they are able to confront new information from the perspective and awareness of their existing knowledge base. When students link new material to their existing conceptual framework, they can create new, meaningful interconnections so that their existing conceptions are enriched in one way or another (Gravett, 2005).

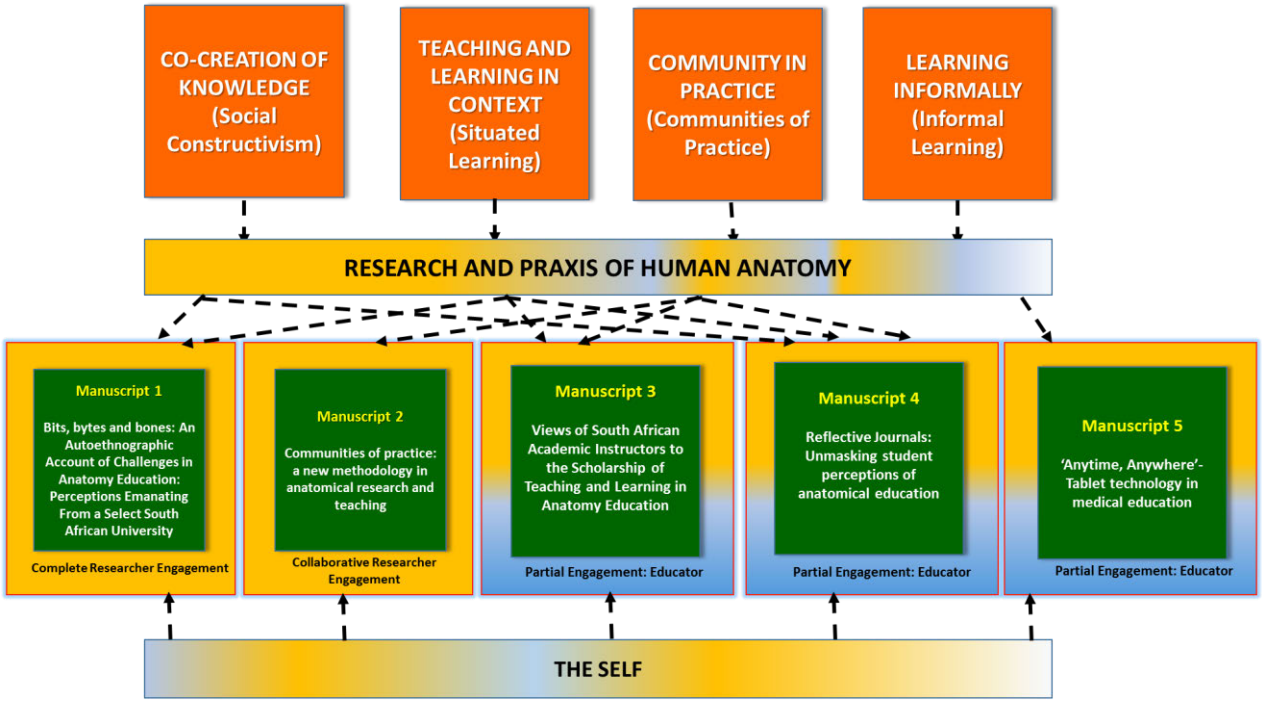


Figure 10: Conceptual framework for research, teaching and learning of human anatomy at a higher education institution in South Africa

The approach to generating a conceptual framework was positioned in the scientific context of the existence of knowledge and the identification of the epistemological lenses were derived from empirical data in Chapters 3 and 4 of this thesis. This is an iterative process between myself and each of the manuscripts (Figure 10).

5.3.6 Anatomical symbolism of conceptual framework

My human anatomy knowledge impels me to use an anatomical structure to depict my conceptualisation of the study. I have opted to use the heart to represent the self with the different chambers and vessels depicting the concepts outlined in Figures 5-10. The overall aim of this study was to explore the research and praxis of human anatomy through autoethnography.

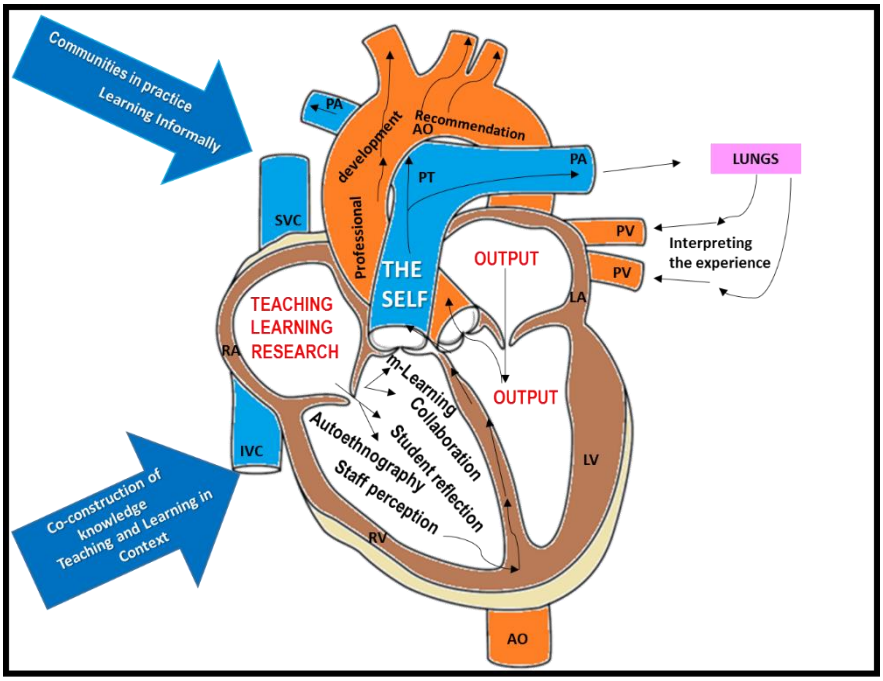


Figure 11: Conceptual matters of the heart: a symbolic auto-ethnographic flow

Key: SVC- superior vena cava, IVC- inferior vena cava, RA – right atrium, RV – right ventricle, LA – left atrium, LV - left ventricle, PT - pulmonary trunk, PA - pulmonary arteries, PV – pulmonary veins, AO - aorta

All of the manuscripts are symbolically seated in the right ventricle as they were investigations and had to follow a particular path in a similar fashion that deoxygenated blood flows into this ventricle and is pumped to the lungs for oxygenation. The results of these investigations are referred to as outputs (which are seated again symbolically in the left atrium and left ventricle for dissemination to the rest of the body via the aorta). Likewise outputs of these investigations have been (a) distributed for publication, (b) recommendations have been made via these manuscripts for change in the way human anatomy is taught and researched, (c) all of this has been captured in the format of this thesis with further recommendations for future studies.

5.4 Insights emerging from the study

The following insights are offered based on the data emerging from this compilation about praxis and research in human anatomy:

- Firstly, teaching and learning are components of praxis and they are processes of active creation, a social phenomenon, as well as an individual experience in the study of anatomy

- Secondly, teaching is a significant aspect of praxis that is intellectual work that must interrogate what counts as knowledge in anatomy. As an educator, I am involved in the teaching and learning of human anatomy and the following three manuscripts, namely,. *Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education, Reflective Journals: Unmasking student perceptions of anatomical education,* and *Anytime, Anywhere- Tablet technology in medical education* provide insights into the praxis of the subject.
- Thirdly, research generation is inextricably aligned to teaching and learning in the generation of rules of inference, models, system, schemes, ideas, principles, concepts, or beliefs (Egbert and Sanden, 2014) in the field of anatomy. This thesis adopts an interpretive stance (reflection and autoethnography), underpinned by educational theories that assume that reality is socially interpreted and that there are multiple realities or interpretations of an event. This is a constructivist theoretical approach, seeking not to find knowledge or fact but rather to recreate it. I was able to accomplish this by interrogating the self through reflection and memory work in the culture that I was situated in , viz. in the research, teaching and learning of human anatomy (which symbolically sits in the right atrium of the heart).This resulted in a manuscript entitled *Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating from a selected South African University* where I was completely engaged as researcher in the entire study. From my experiences as a researcher and educator in human anatomy, I was involved with colleagues in collaborative research, from which emanated the manuscript *Communities of practice autoethnography: a new methodology in anatomical research and teaching* where I was also immersed completely as a researcher albeit in a collaborative manner.
- Fourthly, education theory, specifically learning theories in education contribute to an enhanced understanding of the research and praxis in anatomy.
- Fifthly, this study offers unique methodical insights into alternative approaches in the research and praxis of anatomy education.

5.5 Closing thoughts

"*Doctors without anatomy are like moles. They work in the dark and the work of their hands are mounds*."

[F. Tiedemann, cited in Papa and Vaccarezza (2013; p1)]

The above quotation reinforces the notion that anatomical knowledge is a fundamental component of a medical curriculum to ensure that students have a solid foundation for a complete a medical education. A large component of the thesis utilizes qualitative methodologies which lent themselves to chapters in this study as they allowed for thediscovery of participant opinions. This chapter outlined a conceptual framework for the research and praxis of human anatomy and offered insights in the transforming field of Health Sciences at Higher Education institutions. Methodologically, this is a dissident move away from the traditional positivistic models of research in the domain of anatomical education.

It has been an intense experience in that I have had to explore my deepest and sometimes painful reflections of issues that have impacted on my academic career and how these have influenced my own personal development as well as my professional development as an anatomist.

As a symbolic gesture to the creativity released through the process of this thesis, I offer this poem as a concluding statement which succinctly captures the mood of this study; the challenging highs and lows of researching and practising human anatomy differently:

The winds of anatomy
Did you see the wind?
It was inevitable
The way she shook the table

She's has blown across the plain
Scattering skeletons until it rains
Sending shards and spicules
Scrambling for shelter

Can we survive her ire?
Can we re-direct her?
And rise above her

(The Self: 2016)

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APPENDIX

APPENDIX A

DOCUMENTS RELATED TO DATA COLLECTION

Annexure 1: List of published manuscripts to sample nodal informers

CARDIOVASCULAR ANATOMY

Absent left main coronary artery with variation in the origin of its branches in a South African population.
Ajayi NO, Lazarus L, Vanker EA, Satyapal KS
Anatomia Histologia Embryologia (2015) 44(2):81-85. doi: 10.1111/ahe.12109. Epub 2014 Mar 24.

The intramyocardial left anterior descending artery: prevalence and surgical considerations in coronary artery bypass grafting.
Vanker EA, Ajayi NO, Lazarus L, Satyapal KS.
South African Journal of Surgery. 2014 Feb;52(1):18-21

Double aortic arch: an unusual congenital variation.
Satyapal KS, Lazarus L, Shama D.
Surgical and Radiologic Anatomy. 2013 Mar;35(2):125-9. doi: 10.1007/s00276-012-1030-z. Epub 2012 Oct 13.

Case of Double Superior Vena Cava
B. Singh, L. Ramsaroop, J. Maharaj, A. Reddi
Clinical Anatomy 18:366–369 (2005)

NEURAL ANATOMY

Thoracic origin of a sympathetic supply to the upper limb: the 'nerve of Kuntz' revisited.
Ramsaroop L, Partab P, Singh B, Satyapal KS.
Journal of Anatomy. 2001 Dec;199(Pt 6):675-82.

A thoracoscopic view of the nerve of Kuntz.
Ramsaroop L, Singh B, Moodley J, Partab P, Pather N, Satyapal KS.
Surgical Endoscopy. 2003 Sep;17(9):1498. Epub 2003 Jun 17.

Galen's "Anastomosis" revisited
Naidu L, Ramsaroop L, Partab P, Satyapal KS.
Clinical Anatomy. 2011 Dec 12. doi: 10.1002/ca.22011. [Epub ahead of print]

OSTEO- ANATOMY

Acromial morphology and subacromial architecture in a South African population
N Naidoo, L Lazarus, SA Osman, KS Satyapal
International Journal of Morphology – IJM 024.15

An anatomical investigation of the carotid canal
N Naidoo, L Lazarus, NO Ajayi, KS Satyapal
Folia Morphologica, Manuscript number: FM #38880

Annexure 2: Interview Schedule for Nodal Informers

1. Name:
2. Age:
3. Sex :
4. Race :
5. Qualification:
6. Speciality/Discipline:
7. How long have you been practicing in your specialty or discipline?
8. Have you conducted research exclusively in your specialty or have you engaged in cross discipline research. May I respectfully request you to explain further?
9. Have you found collaborative research work beneficial and how has this collaborative research assisted you in your practice?
10. What is regarded as being cutting edge research in your field and how does this work extend it?
11. Where do your research strengths lie? Can you please elaborate?
12. What are your research weaknesses? Please explain how you would aim to improve this?
13. Please explain how this research work has influenced your teaching, if at all. In what ways have you been able to bring the insights of this research work to your courses at either undergraduate or postgraduate level?
14. How would you involve postgraduate or undergraduate students in such research?
15. Do you have any additional information that you would like to share?

Annexure 3: Schedule of open ended questions for faculty

1.	Name:	_____
2.	Age:	_____
3.	Sex:	_____
4.	Race:	_____
5.	Qualification:	_____
6.	Speciality/Discipline:	_____

7. How long have you been practicing in your specialty or discipline?

8. Are you currently or have you previously been involved in clinical teaching? If so, for how long? May I respectfully request you to explain further?

9. What are your views regarding anatomical education at your Institution?

10. In your opinion do you think that students are taught clinically important anatomy? May I respectfully request you to explain further?

11. In your opinion do you think that students you come across have the proper general anatomical knowledge and the ability to interpret it in a clinical setting? May I respectfully request you to explain further?

12. Do you think that cadaveric dissection to teach anatomy is necessary? Please explain further.

13. What are your views with respect to the use of any additional teaching modalities in anatomy, for example the use of plastinated specimens, the use of computer software packages and radiological images. Further, do you have any suggestions of what teaching resources should be used to teach anatomy adequately

14. Do you have any suggestions to improve the delivery of anatomy knowledge at undergraduate and postgraduate levels?

15. Do you have any additional information that you would like to share?

Annexure 4: Tablet Technology in Medical Education Questionnaire

The purpose of this survey is to provide faculty with information about whether you utilize mobile devices as they relate to your studies in the Anatomy Program. This survey is for general program development and is voluntary. However, your participation is greatly appreciated and will be useful in course planning, development and improvement. Please mark with a tick where appropriate.

Age: _____

Sex:	**M**	**F**	

Population Group:	**Black African**	**White**	**Indian**	**Coloured**

Socio-Economic Background	**Urban**	**Peri-urban**	**Rural**

16. When did you receive your tablet? _____

17. Did you have access to a tablet prior to receiving the current one?

Yes
No

18. Were you familiar with the visual learning programme prior to the provision of the tablet?

Yes
No

19. What do you frequently use the tablet for? (Please cross the most applicable option)

Academic
Personal
Academic and personal
Other

20. How often do you use the tablet to access anatomy-related content? (Please cross the most applicable option)

Everyday
Twice a week
More than three times a week
Once in two weeks
Other

21. Which of the following do you most frequently access via your tablet? (Please cross the most applicable option)

Lecture notes
The actual lecture
Demonstration of prosected specimens

22. Which method of studying anatomy do you find most beneficial to you? (Please cross the most applicable option)

Visual aid (learning via the tablet)
Physical dissection and viewing of prosected specimens

22.1 Please explain your preferred choice:

_____
_____

23. How does the use of the tablet for the access of anatomy-related content assist with your clinical skills?

_____
_____

24. Where do you generally use your tablet? (Please cross the most applicable option)

At campus
At home
At hospital during ward rounds

9.1 Please explain the reason for the selected location?

_____
_____

25. Do you have internet access at home?

Yes
No

25.1 How does this affect the usage of your tablet to access anatomy-related content?

_____
_____

26. Has the tablet made accessing anatomy-related content more convenient for you?

Yes
No

26.1 Please elaborate about your choice

_____
_____

27. What do you consider most beneficial to you? (Please cross the most applicable option)

Live streaming of lectures and practical's only
Physical attendance to lectures and practical's only
Live streaming of lectures AND physical attendance to lectures and practical's
Access of anatomy-related study material only, i.e. lecture notes
Live streaming of lectures AND access of anatomy-related study material, i.e. lecture notes
Physical attendance to lectures and practical's AND access of anatomy-related study material, i.e. lecture notes

28. In addition to the provision of the tablet, do you still record notes during the lecture?

Yes
No

29. What applications do you most frequently use on your tablet? (Please list in order of preference)

4. _____
5. _____
6. _____

30. Does the provision of the tablet affect your attendance to lectures and practical's?

Yes
No

APPENDIX B

DOCUMENTS RELATED TO ETHICAL CLEARANCE

Annexure 1: Ethical Clearance 2015

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

23 October 2015

Mrs L Lazarus (9262120)
Discipline of Anatomy
School of Laboratory Medicine and Medical Sciences
ramsaroopl@ukzn.ac.za

Protocol: The praxis and research of human anatomy through auto-ethnography.
Degree: PhD
BREC reference number: BE386/15

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 24 August 2015.

The study was provisionally approved pending appropriate responses to queries raised. Your responses dated 13 October 2015 to queries raised on 25 September 2015 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given full ethics approval.

This approval is valid for one year from **23 October 2015.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** by a full Committee at its meeting taking place on **10 November 2015.**

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

[redacted]
Professor J Tsoka-Gwegweni
Chair: Biomedical Research Ethics Committee

cc supervisor: satyapalk@ukzn.ac.za
cc postgrad: dudhrajhp@ukzn.ac.za

Annexure 2: Amendment to protocol

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

RESEARCH OFFICE
BIOMEDICAL RESEARCH ETHICS ADMINISTRATION
Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604769 - Fax: 27 31 260-4609
Email: BREC@ukzn.ac.za
Website: http://research.ukzn.ac.za/ResearchEthics/BiomedicalResearchEthics.aspx

11 May 2016

Mrs L Lazarus (9262120)
Discipline of Anatomy
School of Laboratory Medicine and Medical Sciences
ramsaroopl@ukzn.ac.za

Protocol: The praxis and research of human anatomy through auto-ethnography.
Degree: PhD
BREC reference number: BE386/15

We wish to advise you that your letter received 08 April 2016 submitting an application for amendment to the data collection sheets in relation to the above study has been noted and approved by a sub-committee of the Biomedical Research Ethics Committee.

The Committee will be advised of the above at the next meeting to be held on **14 June 2016.**

[redacted]
Mrs A Marimuthu
Senior Admin Officer: Biomedical Research Ethics Committee

cc supervisor: satyapalk@ukzn.ac.za
cc postgrad: dudhrajhp@ukzn.ac.za

Annexure 3: Ethics Re-certification 2016

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI
RESEARCH OFFICE
BIOMEDICAL RESEARCH ETHICS ADMINISTRATION
Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604769 - Fax: 27 31 260-4609
Email: BREC@ukzn.ac.za
Website: http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx

30 August 2016

Mrs L Lazarus (9262120)
Discipline of Anatomy
School of Laboratory Medicine and Medical Sciences
ramsaroopl@ukzn.ac.za

Protocol: The praxis and research of human anatomy through auto-ethnography.
Degree: PhD
BREC reference number: BE386/15

RECERTIFICATION APPLICATION APPROVAL NOTICE

Approved: 26 October 2016
Expiration of Ethical Approval: 25 October 2017

I wish to advise you that your application for Recertification received on **19 August 2016** for the above protocol has been noted and approved by a sub-committee of the Biomedical Research Ethics Committee (BREC) for another approval period. The start and end dates of this period are indicated above.

If any modifications or adverse events occur in the project before your next scheduled review, you must submit them to BREC for review. Except in emergency situations, no change to the protocol may be implemented until you have received written BREC approval for the change.

The approval will be **ratified** by a full Committee at a meeting to be held on **13 September 2016.**

Yours sincerely

[redacted]

Mrs A Mahmudha
Senior Administrator: Biomedical Research Ethics

Annexure 4: Gatekeeper Permission Letters

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

2 October 2015

Mrs Lelika Lazarus (SN 9262120)
School of Laboratory Medicine & Medical Sciences
College of Health Sciences
Westville Campus
UKZN
Email: ramsaroopl@ukzn.ac.za

Dear Mrs Lazarus

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN), towards your postgraduate studies, provided Ethical clearance has been obtained. We note the title of your research project is:

"The praxis and research of human anatomy through auto-ethnography".

It is noted that you will be constituting your sample by conducting interviews with staff members and approaching students to fill in a reflective journal on the Westville and Nelson R Mandela School of Medicine campuses.

Please ensure that the following appears on your questionnaire/attached to your notice:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

Data collected must be treated with due confidentiality and anonymity.

[redacted]

PROFESSOR D JAGANYI
REGISTRAR (ACTING)

ASSA AVSA

Anatomical Society of Southern Africa
Anatomiese Vereniging van Suider Afrika

7 October 2015

To whom it may concern

On behalf of the Anatomical Society of Southern Africa (ASSA), and in my capacity as president of this association, I give permission for Mrs Lelika Lazarus to send out questionnaires to members of ASSA for purposes of her post-graduate study.

Yours sincerely,

Prof M Steyn

President: ASSA

maryna.steyn@wits.ac.za

Zertifikat
Certificat
Certificado
Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Lelika Lazarus

a complété avec succès - has successfully completed

Research Ethics Evaluation

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

[redacted]

June 8, 2015
CID : N1Kssj8eL

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

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[REV : 20140328]

APPENDIX C

PAPERS AND SCIENTIFIC PRESENTATIONS EMANATING FROM STUDY

The following is an outline of the research output from this thesis.

PAPERS IN PRESS

Reflective Journals: Unmasking student perceptions of anatomical education
L Lazarus, R Sookrajh, KS Satyapal
Folia Morphologica: Manuscript number: #48600

PAPERS SUBMITTED AND UNDER REVIEW

'Anytime, Anywhere'- Tablet technology in medical education
L Lazarus, R Sookrajh, KS Satyapal
British Medical Journal-Open: Manuscript number: BMJ Open-2016-013871

Views of South African Academic Instructors to the Scholarship of Teaching and Learning in Anatomy Education
L Lazarus, R Sookrajh, KS Satyapal
African Journal of Health Professions Education: Manuscript number: 871

Communities of Practice: a new methodology in anatomical research and teaching
L Lazarus, R Sookrajh, KS Satyapal
Anatomical Sciences Education: Manuscript number: ASE-16-0159

Bits, bytes and bones: An Autoethnographic Account of Challenges in Anatomy Education: Perceptions Emanating from a selected South African University
L Lazarus, R Sookrajh, K.S. Satyapal
Ethnography: Manuscript number: ETH-16-0097

SCIENTIFIC PRESENTATIONS

PAPERS DELIVERED AT NATIONAL CONFERENCES

1. **Perceptions of senior academic instructors to the scholarship of teaching and learning in anatomy**
   L Lazarus, R Sookrajh, KS Satyapal
   10th Annual Teaching & Learning Conference Higher Education Conference; 20-22 September 2016, Durban, South Africa

2. **An autoethnographic account of challenges facing anatomy education**
   L Lazarus, R Sookrajh, KS Satyapal
   School of Laboratory Medicine and Medical Sciences Research Day
   5 AUGUST 2016, GSB, Westville Campus

3. **Reflective journals: Unmasking student perceptions of anatomical education**
   L Lazarus, R Sookrajh, KS Satyapal
   44th Annual Conference of the Anatomical Society of Southern Africa; 8-11 May 2016; Bloemfontein, South Africa

4. **Autoethnography: Transformation in anatomical education**
   L Lazarus, R Sookrajh, KS Satyapal
   44th Annual Conference of the Anatomical Society of Southern Africa; 8-11 May 2016; Bloemfontein, South Africa

5. **Autoethnography: An evolving methodological praxis in anatomical education**
   Lazarus L, R Sookrajh, KS Satyapal
   43rd Annual Conference of the Anatomical Society of Southern Africa; 9-13 May 2015; Parys, South Africa

6. **A historical perspective of anatomical pedagogy at UKZN: A pilot study**
   L Lazarus, R Sookrajh, KS Satyapal
   8th Annual Teaching and Learning Conference Higher Education Conference; 25-27 September 2014; Edgewood Campus, University of KwaZulu Natal, Durban, South Africa

7. **Pedagogy in Anatomy: A review of its practice at the University of KwaZulu Natal : A pilot study**
   Lazarus L, B Singh, R Sookrajh, KS Satyapal
   42nd Annual Conference of the Anatomical Society of Southern Africa; 13-16 April 2014; Stellenbosch, South Africa

8. **First and second year medical rehabilitation students' attitude toward cadaveric dissection**
   Lazarus L, BB Singh, R Sookrajh, KS Satyapal
   42nd Annual Conference of the Anatomical Society of Southern Africa; 13-16 April 2014; Stellenbosch, South Africa