Looking back at doctoral education in South Africa

Chaya Herman*

Department of Education Management and Policy Studies, University of Pretoria, Pretoria, South Africa

*Email: chaya.herman@up.ac.za

Abstract

This article provides a quantitative picture of doctoral education in South Africa up to 2010, from the time the first doctorate was awarded in 1899. It identifies the different institutional profiles and emphases of doctoral graduation in South African universities at various periods of time in the context of economic, political and social change. In addition, it analyses the progress that has taken place in attaining the national goal of equity, redress and increased research production to allow South Africa to become a player in the knowledge economy.

The article is based on a comprehensive database of all the doctoral degrees awarded by South African universities for over a century. This database was compiled by triangulating various data sources.

Keywords: doctoral education; graduate students; history of higher education; higher degree research; South Africa

Introduction

The shift towards a knowledge economy and the emphasis on the potential contribution of doctoral research to knowledge and innovation highlights the paucity of doctoral graduates in South Africa. The South African government aspires to increase the number of PhD graduates fivefold by 2030 (NPC 2012). This research article looks back in order to look forward towards this goal: "History permits us to understand how the present came to be the way it is, and on the basis of that knowledge we may, perhaps, attempt to forge an alternative future" (Lulat 2005, 23). Yet the long history of the doctoral award in South Africa, which may explain the current scarcity and the potential for growth, is undocumented and relatively unknown. This article aims to address this gap and trace the evolution of the doctoral degree in South Africa over the past century and beyond.

The literature on the history of doctoral education in South Africa is scant, although there are some recent studies that follow the expansion of PhD production and the changes in the demographic profile of the graduates since the transition to democracy in 1994 (ASSAf 2010; CREST 2009). Disparate attempts have been made over the years to follow both qualitatively and quantitatively the development of research initiatives, including postgraduate degrees, in specific disciplines or institutions. For example, Deacon, Osman and Buchler (2010) trace education policy studies in South Africa from 1995 to 2006; Homer and Taylor (2009) follow trends in zoological research from 1980 to 2009; Ocholla and Mostert (2010) follow research trends at the University of Zululand; Meadows (2012) discusses the doctoral degree in Geography; Hodgson and Craig (2005) review zoological studies at Rhodes University; Laugksch (2005) focuses on postgraduates in science education, and Bailey and Cooper (2003) investigate the 1996 cohort of doctoral graduates.

This article aims to investigate the trajectory of the doctoral degree in South Africa since its inception in 1899 when the first Doctor of Law (LLD) was conferred by the University of the Cape of Good Hope (UCGH), one of the first "privileged" British colonial universities (Simpson 1983, 75). It identifies the different institutional profiles and emphases of doctoral graduation in South African universities at various periods of time in the context of economic, political and social change. Crucially, the article identifies patterns of continuity and change and analyses the progress that has taken place in attaining the national goal of equity, redress and global competitiveness. This historical investigation thus uses the doctoral award as a lens through which to trace the development of research capacity and knowledge production within particular subjects and institutions over the past century or so.

The article begins with a methodological section followed by a short introduction to the higher education context in South Africa. It continues with an introduction to the study of the doctorate followed by a decadal analysis of its evolution in South Africa. In addition, the article looks at the demographic shifts in the graduate profile with the transition to democracy in 1994. The final section includes discussion, conclusions and suggestions for further research.

Methodology

In order to trace the history of the doctorate it was necessary to establish a reliable database of all the doctoral awards that have been conferred by South African universities. Such a database was not readily available and, while some universities keep records of their own

awards, others do not. This was the first methodological challenge. The NEXUS database which is managed by the National Research Foundation (NRF) provided me with the initial list of the doctorates awarded since 1919.[1] This information included the name of the candidate, the title of the thesis, the year of completion, the award (PhD, DSc, DPhil, LLD, etc), the awarding university, the subject and the abstract when available. The names of the candidates were used to organise the database and to avoid duplication.

The NEXUS database was found to be problematic, however, with many missing, erroneous and duplicate entries. For example, some master's dissertations were cited as PhDs and vice versa, the NRF subject definition occasionally did not match the topic or the faculty in which the doctorate was awarded, incorrect years of completion were cited, or PhDs were listed under the wrong university. The Health Sciences in particular were inconsistently treated by the NRF – some years they were included in the database and some years they were omitted. A rough estimation concluded that the compiled database is about 10 to 15% more accurate than the NRF database.

For triangulation purposes, each university's available graduate booklets and various other publications were scrutinised. At some universities these were available, for example the University of Cape Town has digitised all its graduation booklets, while at others the graduate booklets of certain years have been lost. In addition, data were lost after the mergers of higher education institutions between 2002 and 2004. For example, Vista University no longer existed after the mergers and most of its records are now unavailable. Attempts were made to verify each entry on the NEXUS database manually against the databases of individual universities when available, and by searching their online library catalogues. This first challenge, of listing and counting the doctorates, was time consuming and complicated, as the same thesis sometimes had two different dates of publication, usually consecutive years (possibly pre- and post-graduation). While some errors doubtless remain, they are deemed not to have had a significant impact on the analysis.

The second methodological task was to categorise the doctoral theses into the various CESMs (Classification of Educational Subject Matter). This was again challenging as the classification systems have changed over time. New fields of knowledge have been

[1] This database lists current and completed South African dissertations, theses, and research projects.

established, as well as multidisciplinary subjects. Some fields of study have moved from one CESM to another over the years, for example 'economy' shifted from the Social Sciences to Business, and the Life Sciences and Physical Sciences became two separate CESMs in the 2008 Subject Matter Categories (DoE 2008). For statistical purposes the 1982 Subject Matter Categories were kept since this categorisation was used by the Higher Education Management Information System (HEMIS) (and its predecessor SAPSE) between 1986 and 2009, the period during which most of the doctorates were awarded.

For triangulation purposes the compiled database, comprising the last two decades (1990–2010), was compared with the HEMIS data, which were only available from 1986.[2] The HEMIS data record the number of doctorates awarded each year by university, CESM, gender and race. A small variation of 1 to 5% was found between the two databases for these two decades. However, there was a 10 to 15% discrepancy in a few CESM categories between the two databases. In the final analysis the HEMIS categories were used for the available decades, as these reflect the way universities categorised their doctoral degrees.

The data collection for this article was a laborious task which took a number of years to complete. Notwithstanding the limitations of the database, this article is based on the unique and most comprehensive records of all doctoral degrees awarded by South African universities.

A bird's-eye view of higher education in South Africa

In 1873, an act of parliament appointed the University of the Cape of Good Hope (UCGH) as an examining university and allowed it to confer academic degrees (Ritchie 1918). The university did no teaching but, until 1918, it laid down the syllabuses, conducted the examinations and awarded degrees in the arts, law, divinity, agriculture, and others (Behr 1988). The UCGH was the only university in South Africa until the end of World War I (Cooper and Subotzky 2001). At the time, it was criticised for being merely "a factory of certificate" and an alien English import (Boucher 1973).

Following independence from Britain and the concomitant formation of the Union of South Africa in 1910, there was rapid growth in university teaching (Cooper and Subotzky 2001). Legislation in 1916 made provision for the establishment of the autonomous universities of Stellenbosch (US) (Act 13 of 1916), Cape Town (UCT) (Act 14 of 1916) and South Africa

[2] The HEMIS replaced the South African Post Secondary (SAPSE) data in 2001.

(UNISA) (Act 12 of 1916). The latter was an examining university to which six institutions were affiliated. The five of these institutions to survive became the University of the Witwatersrand (WITS) in 1922, the University of Pretoria (UP) in 1930, the University of Natal (1948), the University of the Orange Free State catering for urbanising Afrikaners (1950) and Rhodes University (1951). In 1951, Potchefstroom University for Christian Higher Education (PU for CHE), an explicitly Calvinist campus for Afrikaners, came into being. During the 1960s, two additional universities were established, the bilingual University of Port Elizabeth (UPE) and the Rand Afrikaans University (RAU) in Johannesburg.

These universities catered mainly for the white population, with black[3] students having limited access to English language universities, such as WITS and UCT. The University of Natal provided part-time, separate, classes for non-white students in Durban, mostly in subjects leading to a BA degree with a few exceptions. Later on, in 1951, the university opened a medical school for "all suitably qualified non-whites" in Durban (Behr 1978, 135). In the same year, UNISA became a fully-fledged correspondence university catering for all races.

Black university education started with the establishment of the South African Native College in Fort Hare in 1916. In 1923, it became a constituent college of UNISA and, in 1951, it became affiliated to Rhodes University and was renamed the University College of Fort Hare. In 1960, following the Extension of University Education Act of 1959 and in response to the demands of a rapidly expanding economy which required a skilled black workforce, the University College of the North and Zululand came into being under the wing of UNISA and under the control of the Bantu Education Minister. The Act was closely linked to the promotion of Bantu Self-government Act, which provided for the establishment of black higher education institutions (Cooper and Subotzky 2001). The 1959 Act also prohibited whites from attending universities for non-whites, and barred non-whites from attending white universities other than UNISA. The universities of Cape Town, Natal and the Witwatersrand, however, continued to admit some black students with special permits but none of the Afrikaans-medium universities admitted black students (Welsh 2009)

More higher education institutions were established from the 1960s onwards to cater for the growing needs of the black population. In 1978, the Medical University of South Africa

[3] Black refers collectively to all three disadvantaged race groups of Indian, coloured and African.

(MEDUNSA) was established to provide university education in medicine, dentistry and veterinary sciences for blacks. The University of the Western Cape, near Cape Town, was established in 1960 to cater for the coloured community and obtained academic autonomy in 1970. In Durban, the University College for Indians was established in 1961. In 1971, it became an autonomous university – the University of Durban-Westville (UDW). Later on, with the creation of 'self-governing homelands' (Cooper and Subotzky 2001), a branch of Fort Hare at Umtata became the University of Transkei, and the universities of Bophuthatswana, Venda and Ciskei were also established. These universities were mostly teaching universities restricted to undergraduate degrees and diplomas, mainly in the liberal arts, humanities, education and law (Wolpe 1995). In 1981, Vista University was established to cater for blacks residing in urban areas in South Africa. Its administrative campus was in Pretoria but it had decentralised campuses in black townships in Bloemfontein, Port Elizabeth, Pretoria and elsewhere.

By the end of the apartheid era, the residential universities fell into three distinct categories, the English-medium, the Afrikaans-medium and the black institutions, and were structured along ethnic lines. The black institutions were mostly isolated in rural areas (Welsh 2009).

During the middle of the twentieth century technikons were established in South Africa (Act 40 of 1967 to replace the Colleges of Advanced Technical Education (CATEs). Unlike universities, the technikons were vocationally orientated, focusing on practical training, and did not enjoy academic freedom (OECD 2008). Only selected technikons were able to award doctoral degrees (DTech) and that only after 1994.

The long divided and discriminatory history of higher education in South Africa formed a barrier to the production of knowledge and excluded most of the higher education institutions and the majority of the population from studying for higher degrees. After the transition to democracy, the White Paper 3 on the Transformation of Higher Education (Department of Education 1997) called for the expansion of "enrolments in postgraduate programmes at the masters and doctoral levels [in order] to address the [high skills levels] necessary for social and economic development and to provide for the needs of the academic labour market" (section 2.24), as well as for the needs of the "general labour markets" (section 4.56). It prioritised "access of black and women students to masters, doctoral and postdoctoral programmes" (section 2.91). It encouraged the "mobility of students nationally and internationally to undertake postgraduate studies as a means of adding to the skills base"

(section 4.56).

Table 1 Higher education institutions in South Africa: before and after mergers (2002–2005)

NEW INSTITUTION	ABBR.	MERGED INSTITUTIONS
Cape Peninsula University of Technology (est. 2003)	CPUT	Cape Technikon (1920) Peninsula Technikon (1962)
Central University of Technology, Free State (est. 2004)	CUT	Technikon Free State (1981) Vista University (Welkom campus)
Durban University of Technology (est. 2002 as Durban Institute of Technology. Changed name in 2006.)	DUT	Technikon Natal (1907) ML Sultan Technikon (1941) University of Zululand (Umlazi campus)
Mangosuthu University of Technology – 1979	MUT	
Nelson Mandela Metropolitan University (est. 2005)	NMMU	PE (Port Elizabeth) Technikon (1979) University of Port Elizabeth (UPE) (1964) Vista University (Port Elizabeth campus) (1982)
North-West University (est. 2004)	NWU	University of North-West (Formerly the University of Bophuthatswana) – (1960?) Potchefstroom University for Christian Higher Education (PU for CHE) – 1919(1951)*
Rhodes University – 1904(1951)*	RU	
Tshwane University of Technology (Est. 2004)	TUT	Technikon Northern Gauteng Technikon North-West Technikon Pretoria
University of Cape Town – 1829(1918)*	UCT	
University of the Free State – 1904(1950)* (changed its name from the University of Orange Free State (UOFS) in 2001)	UFS	
University of Fort Hare – 1916(1970)*	UFH	
University of Johannesburg (est. 2005)	UJ	Rand Afrikaans University (RAU) – 1968 Technikon Witwatersrand Vista University (Johannesburg campuses)
University of KwaZulu-Natal (est. 2004)	UKZN	University of Natal – 1910(1948)* University of Durban-Westville (UDW) – 1961(1971)*
University of Limpopo (est. 2005)	UL	University of the North (UN) – 1959(1970)* Medical University of South Africa (MEDUNSA) (1978)
University of Pretoria – 1908(1930)*	UP	
University of Stellenbosch - 1866(1918)*	US	
University of South Africa – 1916(1951)**	UNISA	
University of the Western Cape – 1959(1970)*	UWC	
University of the Witwatersrand – 1904(1922)*	WITS	
University of Venda – 1982	UNIVEN	
University of Zululand – 1961(1970)*	UniZulu	
Vaal University of Technology (est. 2004)	VUT	Vaal Triangle Technikon (1979–2003)
Walter Sisulu University (est. 2005)	WSU	University of the Transkei (UNITRA) (1976–2004) Border Technikon Eastern Cape Technikon

*First date refers to the establishment of the institution. Second date in brackets refers to the year when the university was granted independent status enabling it to award doctoral degrees.

**Initially Unisa was an examining and awarding body for other universities. It became a fully-fledged correspondence university in 1951.

In 2001/2 the newly appointed democratic government set about a merger process aimed at reducing the number of higher education institutions. This was done as a means to remove the apartheid racial classification of higher education institutions, to redistribute resources and to bring historically disadvantaged institutions which were isolated and on the periphery of scholarship into the hub of academic life. The mergers and incorporations reduced the number of higher education institutions from 36 to 23. Three types of institution were subsequently created: traditional universities, universities of technology (the old technikons) and new comprehensive universities combining both types of education (see Table 1). All institutions were now able to award degrees including doctorates.

The doctorate in South Africa: from the beginning

In 1899, the first Doctor of Law (LLD) was conferred on WA Macfadyen by the University of the Cape of Good Hope (UCGH). Soon thereafter, in 1907, the first Doctor of Science (DSc) was conferred on PC Juritz by UCGH. By the 1920s, Doctor of Philosophy degrees (PhD and DPhil) were offered by both the University of Cape Town (UCT 1922; Phillips 1993) and the University of the Witwatersrand (WITS 1922).

According to the yearbooks of the different institutions, the degree of Doctor of Law (LLD) was initially awarded by examination only (UCGH 1899), while the degree of Doctor of Science (DSc) was awarded on the submission of an original thesis (UCGH 1906–1907). By 1915 an original thesis was also a requirement for the LLD in addition to an examination (UCGH 1915–1916).

Most history books on higher education in South Africa, or on individual universities, do not focus on the development of the doctoral degree. Murray (1997) briefly mentions that WITS introduces the PhD degree in the faculties of Science, Engineering, Arts and Commerce as part of a drive to promote postgraduate study. He maintains that prior to the Second World War, WITS offered so-called 'senior' doctorates: the Doctor of Literature (DLitt), Doctor of Philosophy (DPhil) Doctor of Laws (LLD), Doctor of Science (DSc), Doctor of Engineering (DSc (Eng)), and Doctor of Medicine (Md), among others. These were the outcomes of unsupervised research and, in the main, were attained by members of the academic staff. According to Murray (1997), the PhD[4] was only introduced in 1949 in the faculties of

[4] The PhD (Philosophiae Doctor) originated in Germany and was imported into North America during the 19th century. The first PhD in North America was awarded at Yale University in 1860. In the UK, the PhD (or DPhil) was first awarded at Oxford and Cambridge at the beginning of the 1920s. The

Science, Engineering and Arts and was instituted as a 'junior' doctorate for candidates who carried out research under supervision, with the Senate establishing a Higher Degrees Committee to control the award of the PhD degree in these faculties.[5] While this was generally the case at most universities, the graduation booklets from UCT indicate that PhDs were awarded as early as 1922,[6] mostly in the Faculty of Science, and the first PhD at the US was awarded in 1933 in African Languages.

With time, the distinction between the PhD and other doctoral degrees has become blurred and the requirements as specified in the Higher Education Qualification Framework of 1997 were basically the same, regardless of the designators (RSA 2007). Some universities simplified the process and use the designator PhD as generic for all faculties instead of using other designators such as DLitt, DPhil, and DCom. These are sometimes regarded as senior doctorates.

How many PhDs?

From 1898 until 2010, South African universities produced about 30 000[7] doctorates. Figure 1 indicates a consistent growth in the number of the doctorates awarded each decade. Although the total number of doctorates awarded in the 1930s was approximately four times greater than the decade before, few candidates pursued doctoral awards (263 doctoral awards in the 1930s in a population of approximately 10 million). Actually, 90% of all doctorates were awarded between 1970 and 2010, with 60% of all doctorates being awarded since the transition to democracy in the 1990s.

From the 1940s, consistent growth of about 180% per decade took place until the end of 1970s, followed by a decline in the growth rate in the 1980s (159%) and a further decline in the 1990s (135%). Although the number of PhDs increased from 6989 in the 1990s to 10 987 in the first decade of the 21st century, this increase reflects a growth of only 157% (Table 2).

PhD signified a transition towards a higher degree which required an original written thesis that makes made a significant contribution to knowledge, and acknowledges the degree holder's competence to carry on an independent research (Noble 1994). After the Second World War, the PhD was exported to other countries with higher education system modelled on that of the UK, including Australia and New Zealand (Taylor 2012).

[5] According to the graduation booklets, the first three PhDs at WITS were awarded in 1949 in Chemical Engineering, Physics and Musicology.

[6] The PhD degree awarded to Sydney Harold Skaife in 1922. Subject of thesis: Monograph on the Bruchidae of South Africa.

[7] The compiled database has 29 791 entries which were rounded up to accommodate potentially missing data.

Figure 1 Doctoral degrees awarded by South African universities (1899–2010)

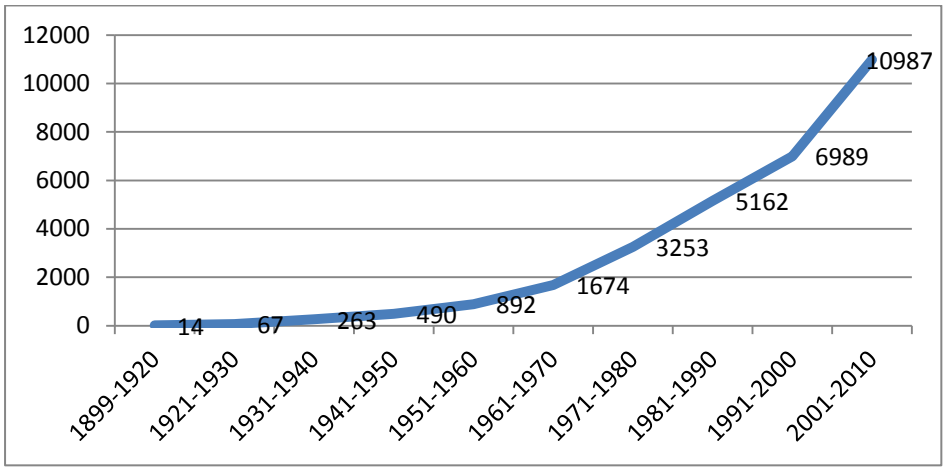


Table 2 Percentage change in the number of doctoral graduates by decade

Years	No of doctorates	Percentage growth
1989-1920	14	479%
1921-1930	67	393%
1931-1940	263	186%
1941-1950	490	182%
1951-1960	892	188%
1961-1970	1674	194%
1971-1980	3253	159%
1981-1990	5162	135%
1991-2000	6989	157%
2001-2010	10987	

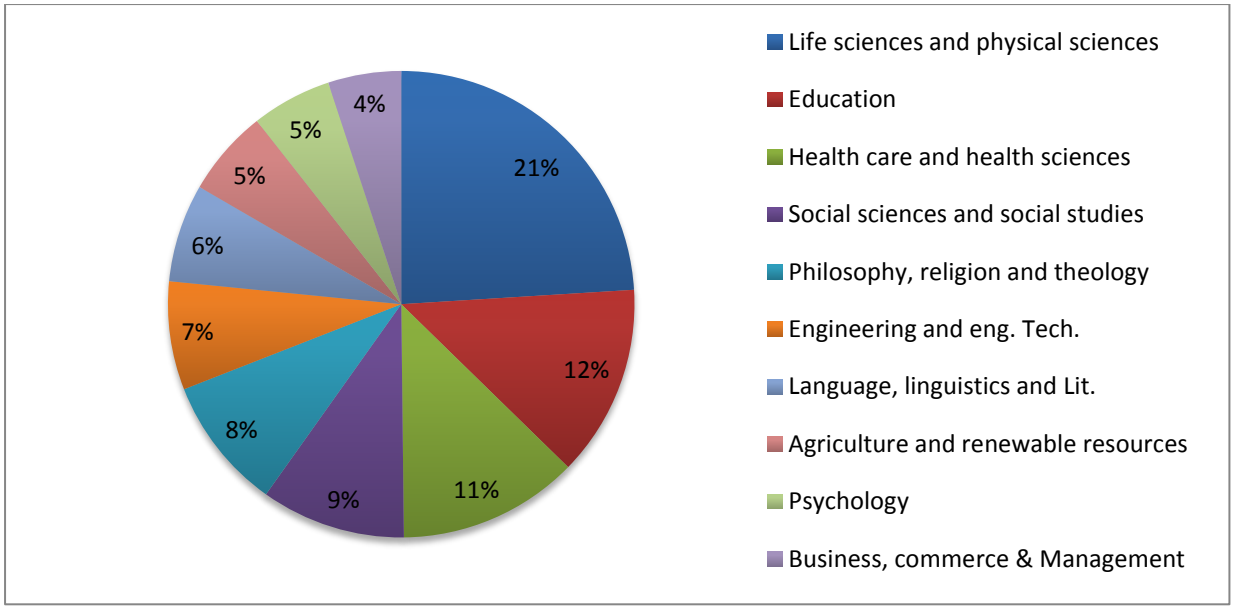
It thus seems that the decadal increases up to the 1970s were greater than those from the 1980s to 2010. This demonstrates that the potential for growth was curtailed in the 1980s, which undoubtedly relates to the political instability, the economic recession, the brain drain and the increased international isolation which affected scientific activities and increased the political violence that preceded the transition to democracy in 1994 (Behr 1988). The growth of just 157% in the first decade of the 21st century also calls into question the capacity of South African higher education institutions to fulfil the aspirations of government for a fivefold increase in doctoral graduates by 2030 (NPC, 2012). A number of studies and commissioned reports attribute the slow progress in the post-apartheid era to insufficient funding, the prevalence of the apprenticeship model of supervision, a scarcity of students,

limited supervisory capacity, lack of recognition in the value of the doctorate and higher learning, limited and inadequate partnerships with industry, lack of diversity in PhD programmes, an inefficient higher education system and high attrition rates (ASSAf, 2010; Herman, 2011; Mouton, 2011; NPC, 2012)

In what subjects?

In looking to describe the early years of the doctorate in South Africa, it is evident that the main driver was the sciences, and this continued throughout the decades. Twenty-one per cent of all doctoral degrees were awarded in the Life Sciences & Physical Sciences, followed by Education (12%) and the Health Care & Health Sciences (11%) (Figure 2).

Figure 2 Doctoral degrees by CESM (1899–2010)



The prominence of Life Sciences & Physical Sciences is particular evident in the first decade of the 21st century. This can be attributed to policy emphasis on increase output in these subjects. Most of the doctorates in the sciences were produced in historically white institutions: UCT produced about 1133 (17%) of all doctorates in Life Sciences & Physical Sciences, followed by WITS (987–15%) and UP (806 – 12%). However, one can detect a growing capacity at historically black university such as UWC, which produced a few PhDs in Life Sciences & Physical Sciences during the 1980s and 1990s, but awarded 124 PhDs in this CESM in the first decade of the 21st century, in excess of a tenfold increase.

The most significant growth in the first decade of the 21st century can be seen in Business, Commerce & Management (an almost threefold increase over the 1990s), in Agriculture & Renewable Resources and in Health Sciences. This indicates a shift towards applied subjects, which are aimed at the labour market, employability and entrepreneurship. There has also been a significant increase in doctoral awards in Philosophy, Religion and Theology, with a focus on pastoral studies (Figure 3). This concurs with the ASSAf (2011) report on the state of the Humanities in South Africa, which also indicates that Religion (principally Theology) leads in terms of research production, mainly articles; however, at the same time it shows that it does not adhere to the call for equity and diversity, with only 9% of the total output in this field being published by black scholars and women.

Slow growth is demonstrated in Engineering, which may hinder South Africa's aspiration to become globally competitive in a field that is understood to be critical to national development. There was also slower growth in the Social Sciences in the first decade of the 21st century (Figure 3). A report on the status of the Humanities, which includes both Social Sciences and the Arts, concluded that the administration of government policy in the post-apartheid era has systematically benefitted Science, Technology, Engineering and Mathematics and disadvantaged the Humanities disciplines (ASSAf, 2011). The slow growth, and, at times, decline in the Humanities, with the exception of Education, were also attributed in this report to a lack of government funding, institutional choices and decision-making, school guidance and counselling, as well as to parental and student preferences.

Becher's (1994) categorised academic subjects into: (1) pure-hard subjects such as Physics, which are organised, depend on cumulative hierarchical knowledge and command higher status; (2) hard-applied subjects, such as Engineering, which derive their underpinnings from hard pure enquiry, are concerned with mastery of the physical environment and are geared towards products and techniques (both (1) and (2) are competitive and entrepreneurial with either a high publication rate or the production of patents); 3) soft-pure subjects, such as History, which are individualistic, loosely structured and have an indirect impact on practice; and 4) soft-applied subjects, such as Education and Business Management, which are uncertain in status and have a lower publication rate.

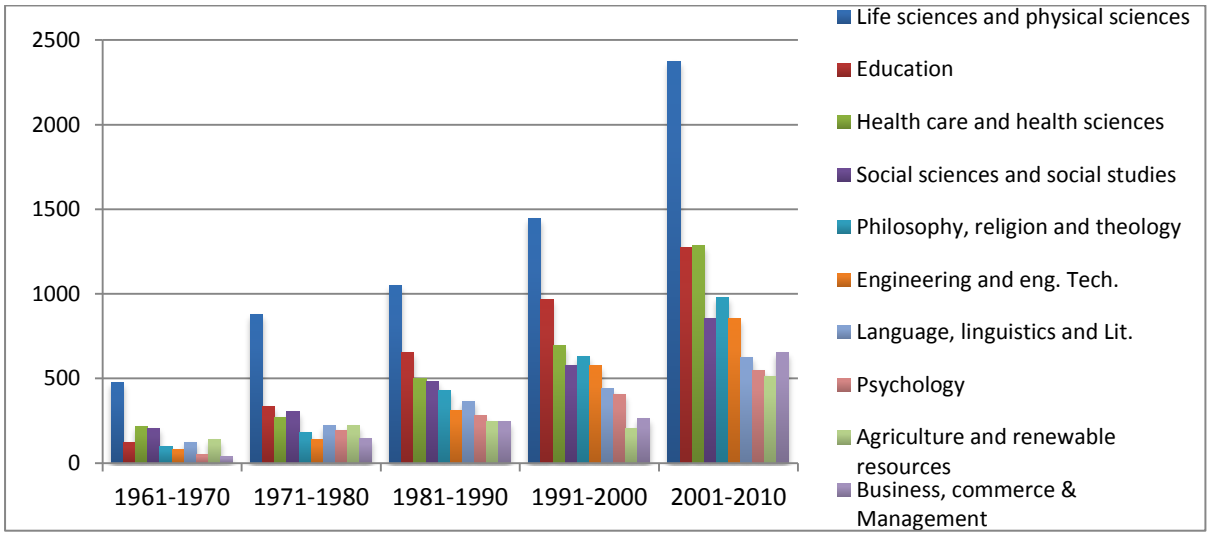
The tendency towards soft-applied subjects is evident in Unizulu, a previously disadvantaged university, which produced 28% of its PhDs in Education followed by Psychology (14%). This trend is particularly evident in merged institutions such as UJ, where the most

significant increase after the merger was in Business, Commerce & Management (a twofold increase from 68 PhDs in the 1990s to 140 PhDs in the 2000s) and in Philosophy, Religion & Theology (from 17 PhDs in the 1990s to 44 PhDs in the 2000s). Another merged institution, NWU, showed a fourfold increase in Business, Commerce & Management (from 23 PhDs in the 1990s to 98 in the 2000s) and a threefold increase in Philosophy, Religion and Theology (from 48 PhDs in the 1990s to 129 PhDs in the 2000s). This is indicative of the fact that the growth in these soft-applied subjects requires very little infrastructure and can reflect an entrepreneurial tendency at the institution, as well as its focus on the labour market, which attracts students, while Science and Technology research requires experienced supervisory capacity and specialised laboratory equipment which previously disadvantaged universities may not have.

The merger between the University of Natal and UDW is a good example of the knowledge divide that was prevalent during the apartheid era. While UDW, a previously black university, awarded most of its PhDs from 1971 to 2004 in soft-applied or soft-pure disciplines such as Philosophy, Religion & Theology (20%), Education (14%), Social Sciences & Social Studies (13%) and Public Administration & Social Services (12%), the University of Natal, as a previously white university, awarded most of its doctorates from 1950 to 2003 in hard-pure or hard-applied disciplines such as Life Sciences & Physical Sciences (33% of all doctoral awards), Agriculture (13%) and Engineering (10%). The merger in 2004 created a mix of hard and soft disciplines, whereby Life Sciences & Physical Sciences still led, producing 22% of all PhDs between 2004 and 2010, followed by Social Sciences (12%) and Education (11%).

This analysis shows that the previous advantaged universities still produce the majority of the PhDs in the hard-pure or hard-applied disciplines, while newly merged universities or previously black universities adhere to the national call to produce more PhDs by focusing on mainly soft-applied subjects. This preserves the historical knowledge divide, whereby apartheid policies systematically excluded most black people from the Sciences and Engineering while at the same time creating an oversupply of black graduates in the Humanities (ASSAf, 2011).

Figure 3 Doctoral degrees by CESM and by decade (1961–2010)



Where?

About 90% of all doctoral degrees in South Africa were awarded by eight previously white institutions (Table 3). The University of Pretoria has consistently awarded the most doctorates per decade since the 1940s.

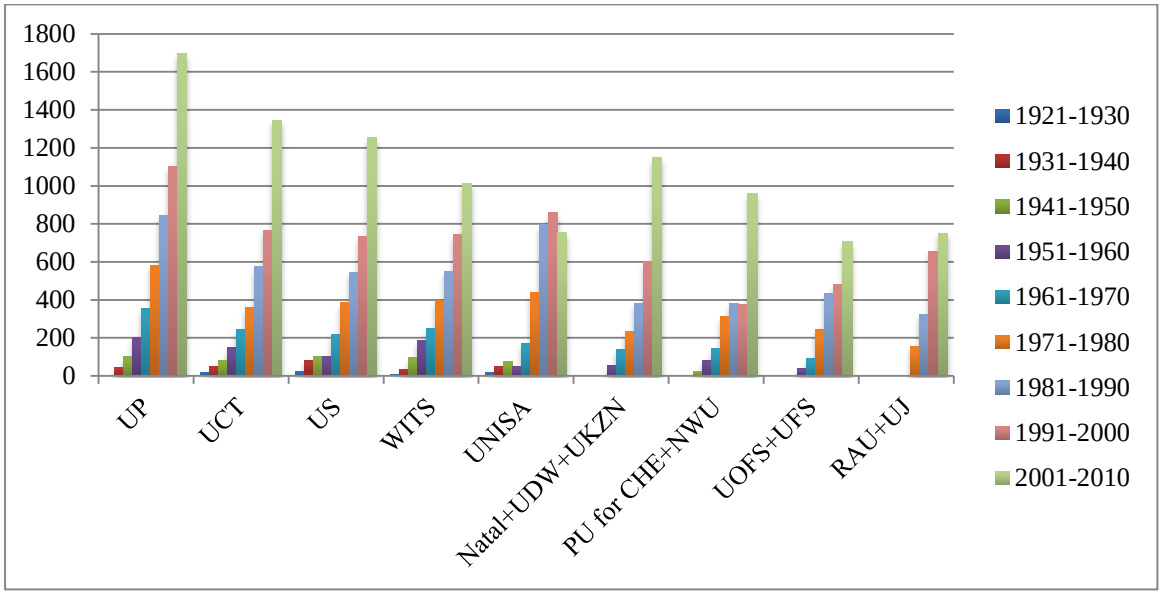
Table 3 Doctoral degrees by institution (1899–2010)

University	No. of doctoral degrees	Percentage
UP	4920	16
UCT	3583	12
US	3446	12
WITS	3269	11
UNISA	3210	11
UKZN (Incl. Natal+UDW)	2552	9
NWU (Incl. U for CHE)	2273	8
UFS (Inc. UOFS)	1993	7
UJ (Inc. RAU)	1878	6
RU	918	3
NMMU (Incl. UPE)	813	3
UWC	482	2
UniZulu	340	1
UFH	116	0
TUT	107	0

The capacity to award doctoral degrees has remained in these previously advantaged institutions even after the transition to democracy, as Figure 4 clearly demonstrates. It can also be seen that there has been significant growth in the number of graduates at the merged institutions of UKZN and NWU. While UNISA awarded the most PhDs after UP from the 1970s to the 1990s, it is the only institution that had a decrease in the number of doctoral graduates in the first decade of the 21st century (Figure 4) – from 860 PhDs in the 1990s to 754 PhDs in the 2000s – with the largest percentage of PhDs being awarded in Philosophy, Religion & Theology (191 or 25% of all PhDs), followed by Education (115 PhDs or 15%).

The gap between the institutions' capacity to award the PhD led to political debate around the issue of differentiation and whether dedicated universities should be funded to remain the top research producers (Cloete 2014). To date, South Africa has been reluctant to make that distinction given that the top PhD awarding universities are formerly white universities.

Figure 4 Doctoral awards by institution and by decade



To whom?

The only complete data on race and gender in South African universities is available from HEMIS from 1986. However, it is instructive to analyse WITS awards from 1922 to 1980, which have been aggregated by gender by the institution itself.[8] During these seven decades women constituted 14% of all PhD graduates, mostly in the Arts (28% of all Arts graduates)

[8] This table was taken from WITS graduation booklet of 1981 which was a celebration of the awarding of 50 000 degrees and diplomas at the university.

and Sciences (18% of all Science graduates) (Table 4). This is a clear indication of the gender bias even in the more liberal universities such as WITS.

Table 4 WITS doctoral awards by faculty and gender (1922–1980)

		Male	Female	Total
Faculty of Arts	PhD	112	42	154
	DLitt	23	1	24
Faculty of Science	PhD	272	55	327
	DSc	50	6	56
Faculty of Medicine	PhD	31	4	35
Faculty of Engineering	PhD	115	0	115
	DSc	29	0	29
	DEng	3	0	3
Faculty of Commerce	PhD	12	0	12
	DSc Econ	2	0	2
Faculty of Law	PhD	1	0	1
	LLD	1	0	1
Faculty of Dentistry	PhD	2	0	2
	DSc (Dent)	7	0	7
Faculty of Architecture	PhD	2	1	3
	DSc (Arch)	1	0	1
	DArch	2	0	2
Education	PhD	2	0	2
		667	109	776
		86%	14%	

Table 5 demonstrates the transformation of the higher degree from being awarded almost exclusively to whites and mainly males, to becoming more diverse and inclusive – from 93% white graduates in 1990 to 48% in 2010 and from 76% of male graduates in 1990 to 58% in 2010. However, the argument that the distribution of PhDs is not demographically representative is still valid.

Table 5 Doctoral awards in South African universities by race and gender (1990–2010)

CESM/ gender	1990		2000		2010	
	No.	%	No.	%	No.	%
African females	0	0%	41	5%	165	12%
African males	18	3%	119	14%	378	27%
Coloured females	0	0%	10	1%	34	2%
Coloured males	4	1%	28	3%	47	3%
Indian females	2	0%	21	3%	52	4%
Indian males	16	3%	27	3%	54	4%
White females	143	24%	266	32%	340	24%
White males	421	70%	309	38%	341	24%
All males	459	76%	483	59%	820	58%
All females	145	24%	338	41%	591	42%
All Africans	18	3%	160	19%	543	38%
All coloureds	4	1%	38	5%	81	6%
All Indians	18	3%	48	6%	106	8%
All whites	564	93%	575	70%	681	48%
Total	**604**		**821**		**1411**	

However, transformation cannot be only about numbers. An analysis of the graduates of 2010 by CESM, race and gender indicates that African males constituted the highest percentage of doctoral graduates in Agriculture and Related Sciences (45% of all graduates in this CESM), Business, Economics and Management (31% of all graduates), Physical Sciences (40%), Social Sciences (32%) and Education (26%), while white males constituted the highest percentage in more lucrative CESMs, such as Computer and Information Studies (40%) and Engineering (52%). Interestingly, white males also represented 49% of all graduates in Philosophy, Religion and Theology. White females were highly represented in the Health Professions (36%), Life Sciences (37%) and Languages, Linguistics and Literature (28%) (Table 6).

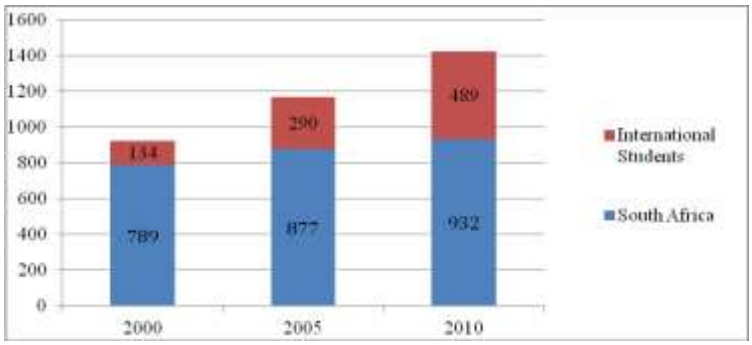
Table 6 Percentage of doctoral graduates by race gender and CESM (2010)

	White males %	White females %	Indian males %	Indian females %	Coloured males %	Coloured females %	African males %	African females %
Agriculture and Related Sciences	19	20	2	3	0	0	**45**	11
Business, Economics And Management Studies	23	20	9	5	1	1	**31**	11
Computer And Information Sciences	**40**	10	3	3	3	0	33	7
Education	12	22	2	5	7	6	26	20
Engineering	**52**	7	5	0	3	0	28	6
Health Professions And Related Clinical Sciences	14	**36**	5	5	2	6	10	22
Languages, Linguistics And Literature	22	**28**	4	2	2	0	27	16
Life Sciences	24	**37**	3	4	3	3	18	9
Physical Sciences	20	15	4	5	5	4	**40**	7
Philosophy, Religion And Theology	**49**	14	4	0	5	1	21	7
Social Sciences	12	23	1	5	3	3	**32**	20

It is important to note that the increase in the number of African students, especially in the Physical Sciences and Agriculture, is linked to the increase in the number of international students from the SADC countries and the rest of Africa. Data on international students in South Africa are only available from 2010 when HEMIS started recording nationality. International doctoral students constituted 19% of all graduates in 2000 and the percentage went up to 34% in 2010 (Figure 5). Thus, while international students show a growth of 365% between 2000 and 2010, South African graduates show a growth of only 118%. This finding is echoed in Cloete et al (2015), who compared data from 2000 to 2012. In the space these 12 years the number of South African graduates increased by 78%, while the number of international graduates increased by 370%. A survey of doctoral students in 2009 explored the intentions of international students studying in South Africa to stay in the country, not actual behaviour. It found that some 37% of the international students intended to stay in South Africa after completing their doctoral studies, with 50% intending to return to their home countries and 13% was undecided (Herman 2009). Thus, the contribution of the international students to building a knowledge economy in South Africa or to increase research and supervisory capacity in South African universities is questionable. The contra argument is that all the countries in the SADC region are interdependent and having international students that may strengthen southern African economies will inevitably result in an improvement in the South African economy (DHET 2013) (see Cloete et al 2015 for a

detailed discussion).

Figure 5 Doctoral graduates by nationality (2000–2010)



Source: HEMIS

Discussion

While South Africa has produced approximately 30 000 PhD degrees since 1899, Australia, another former British colony, which only introduced the PhD degree in 1948, had awarded more than 94 000 PhDs by 2009 (Dobson 2012). Thus, during the same time as South Africa had graduated 26 PhDs per million of the population in 2007, Australia produced ten times more graduates per year (264 per million of population in 2007). This relates to, among other factors, supportive policy, increased participation by women and international students, as well as the introduction of diversified programmes (Dobson 2012). It is evident that in spite of the long history of the doctorate, years of exclusivity and discrimination and the absence of a PhD culture (Cooper 2005) have stunted the development of knowledge production and research capacity at doctoral level in South Africa, with devastating consequences. In the post-apartheid era, a number of barriers, such as inadequate funding, a small pool of candidates, high attrition rates and limited supervisory capacity are hindering the expansion of doctoral production to the aspired level.

This investigation into the history of doctoral education established that there have been some changes and some continuity in the provision of the degree in South Africa. Consistent growth has been experienced in the graduation rate but not at the pace that will provide for the envisaged fivefold increase by 2030, unless extreme intervention takes place, in particular with regard to an increase in the pool of PhD candidates and in supervisory capacity. Science has maintained its prominence among the CESMs over the years, while the Social Sciences

have been in decline in recent years. Furthermore, in the first decade of the 21st century, Education, Religion and Psychology constitute more than 50% of all doctoral graduates in the Social Sciences. This indicates the growth in professional fields (graduates mostly work as school principals and teachers, ministers of religion, and counselling and clinical psychologists). At the same time, the number of graduates in the more traditional and 'fundamental' Humanities disciplines, such as Economics, History, Philosophy, Politics and Sociology is in decline. It would seem that doctorates are mainly produced for the labour market and not necessarily to strengthen research and scholarship (ASSAf, 2011).

The most significant change is in the demographic of the graduates. This article highlights the historically marginalised position of women in postgraduate education, and their increased representation in the first decade of the 21st century. The demographic profile of the graduates in terms of race grouping has changed dramatically over the last two decades, from an exclusively white graduate population to over 50% black. Nevertheless, it is evident that the increase in the number of African graduates can also be attributed to the influx of international students from other countries in Africa. The graduation of international students is growing at almost three times the rate of South Africans. Accordingly, policy and resources should be directed at ensuring that more South African blacks graduate in subjects that are imperative for national development, notwithstanding South Africa's aspiration to become a regional hub.

The previously white universities retain their prominence and the capacity to award PhDs, although there is evidence of a growing capacity and willingness in some previously black institutions to produce more PhDs. It is evident that newly merged universities and some previously black universities have heeded the national call to increase the number of PhDs in mainly soft/ or soft-applied fields such as education, philosophy or business, while the previously white universities continue to produce PhDs in hard/ or hard/applied subjects, thus maintaining the knowledge divide. However, the unending political debate between transformation and differentiation hinders decisive action that could redress the uneven distribution of graduates across universities and disciplines.

While this article paints the history of doctoral education in South Africa in broad brushstrokes, it is nevertheless based on a unique and comprehensive database that has not previously been available. Dobson (2012, 96), who investigated the development of the PhD in Australia from the beginning, concedes that "the fascination that some of us have for

counting and measuring things is not shared by all, but keeping statistics can prove useful for many purposes". To have a greater understanding of the trajectories of doctoral education in South Africa, the underlying causes and the drivers that shaped these trajectories, this quantitative analysis needs to be complemented by detailed case studies that will explore in depth the evolution of the doctorate in individual subjects and universities at various points in time.

References

Academy of Science of South Africa (ASSAf). 2010. *The Phd Study: An Evidence-Based Study on How to Meet the Demands for High-Level Skills in an Emerging Economy.* Consensus Report. Pretoria: The Council of the Academy of Science of South Africa.

Academy of Science of South Africa (ASSAf). 2011. *Consensus Study on the State of the Humanities in South Africa: Status, Prospects and Strategies.* Pretoria: The Council of the Academy of Science of South Africa.

Bailey, Tracey, and David Cooper. 2003. "Profile of Doctoral Awards in South Africa: A Case Study of the 1996 University Cohort." *Society in Transition* 34 (1): 104–28.

Becher, Tony. 1994. "The Significance of Disciplinary Differences." *Studies in Higher Education* 19 (2): 151–61.

Behr, Abraham Leslie. 1978. *New Perspectives in South African Education*. Durban: Butterworths.

Behr, Abraham Leslie. 1988. *Education in South Africa: Origins, Issues and Trends 1652–1988*. Pretoria and Cape Town: Academia.

Boucher, Maurice. 1973. *Spes in Arduis: A History of the University of South Africa*. Pretoria: UNISA.

Centre for Research on Science and Technology (CREST). 2009. *Doctoral Students in South Africa: A Statistical Profile*. Commissioned paper for the ASSAf Consensus Study on PhD production. Unpublished

Cloete, Nico. 2014. "The South African Higher Education System: Performance and Policy." *Studies in Higher Education* 39 (8): 1355–68.

Cloete, Nico, Charles Sheppard, and Tracy Bailey. 2015. "South Africa as a PhD hub in Africa?" in *Knowledge Production and Contradictory Functions in African Higher Education,* edited by Nico Cloete, Peter Maassen and Tracy Bailey Vol. 1. Chapter 5, 75–108. African Minds Higher Education Dynamics Series.

Cooper, David, and George Sabotzky. 2001. *The Skewed Revolution: Trends in South African Higher Education 1988–1998*. EPU.

Cooper, David. 2005. *The Knowledge Society and the Historical Emergence of the "Third Mission" for Universities: Research for Societal Development?* Paper presented at Higher

Education Studies Working Group session SASA (South African Sociological Association) 26–29 June, University of Limpopo, Polokwane.

Department of Education (DoE). 1997. *Education White Paper 3: A Programme for the Transformation of Higher Education.* Pretoria: Government Printer.

Department of Education (DoE). 2007. *Higher Education Qualification Framework.* Pretoria: Government Printer.

Department of Education (DoE). 2008. *CESM: Classification of Educational Subject Matter.* Pretoria: Government Printer.

Department of Higher Education and Training (DHET). 2013. *White Paper for Post-School Education and Training: Building an Expanded, Effective and Integrated Post-School System*. Pretoria: Department of Higher Education and Training.

Department of Science and Technology (DST). 2008. *Innovation Towards a Knowledge-based Economy: Ten-year Innovation Plan 2008–2018.* Pretoria: Department of Science and Technology.

Dobson, Ian R. 2012. "PhDs in Australia: From the Beginning." *Australian Universities Review* 54 (1): 94–100.

Deacon, Roger, Ruksana Osman, and Michelle Buchler. 2010. "Education Policy Studies in South Africa, 1995–2006." *Journal of Education Policy* 25 (1): 95–110.

Hodgson, A.N., and A.J.F.K. Craig. 2005. "A Century of Zoology and Entomology at Rhodes University, 1905–2005." *Transactions of the Royal Society of South Africa* 60 (1): 1–18.

Herman, Chaya. 2009. *A Survey of Current PhD Students in South African Universities*. Commissioned paper for the ASSAf Consensus Study on PhD production. Unpublished.

Herman, Chaya. *2011.* Expanding doctoral education in South Africa: Pipeline or pipedream? *Higher Education Research & Development,* 30(4): 1-13.

Homer, M., and P.J. Taylor. 2009. "Trends in Zoological Research in South Africa 1980–2009." *African Zoology* 44 (2): 232–240.

Laugksch, Rüdiger C. 2005. "Analysis of South African Postgraduate Degrees in Science Education: 1930–2000." *Science Education* 89 (3): 418–32.

Lulat, Y.G.-M. 2005. *A History of African Higher Education from Antiquity to the Present*. Wesport, Connecticut and London: Praeger.

Meadows, Michael E. 2012. "The Doctoral Degree in Geography: A South African Perspective." *Journal of Geography in Higher Education* 36 (1): 49–55.

Mouton, Johann. (2011) Doctoral production in South Africa: Statistics, challenges and responses. *Perspectives in Education,* Vol. 29 special issue nr.3, p. 13-29

Ocholla, Dennis, and Janneke Mostert. 2010. "The Research Trends of Arts, Humanities, and Social Sciences Research at the University of Zululand, 1994–2008." *Inkanyiso: Journal Humanities and Social Sciences* 2 (1): 32–42.

Organisation for Economic Co-Operation and Development (OECD). 2008. *Review of National Policies for Education South Africa.* OECD Publication.

http://www.education.gov.za/LinkClick.aspx?fileticket=sKsxhYorWOk= (Accessed 9 June 2015).

National Planning Commission (NPC). 2012. *National Development Plan 2030. Our Future – Make It Work.* http://www.npconline.co.za/MediaLib/Downloads/Downloads/NDP%202030%20-%20Our%20future%20-%20make%20it%20work.pdf (Accessed 7 December 2014).

Noble, Keith Allan. 1994. *Changing Doctoral Degrees: An International Perspective.* Buckinghamshire: SRHE and Open University Press.

Murray, Bruce K. 1997. *Wits the Open Years. A History of the University of the Witwatersrand, Johannesburg 1939–1959.* Johannesburg: Witwatersrand University Press.

Philips, Howard. 1993. *The University of Cape-Town 1918–1948: The Formative Years.* Cape Town: UCT Press.

Republic of South Africa (RSA), Ministry of Education. 1997. *The Higher Education Qualifications Framework.* Policy issued under the Higher Education Act No.101 of 1997. Pretoria.

Ritchie, William. 1918. *The History of the South African College 1829–1918*. Cape Town, Maskew Miller.

Simpson, Renate. 1983. *How the PhD came to Britain: A Century of Struggle for Postgraduate Education.* Guildford: SRHE.

Taylor, Stanley Edward. 2012. "Changes in Doctoral Education: Implications for Supervisors in Developing Early Career Researchers." *International Journal for Researcher Development* 3 (2): 118–138.

University of Cape of Good Hope (UCGH). 1899. *Calendar 1899*. Cape Town: UCGH and J.C. Juta and Co.

University of Cape of Good Hope (UCGH). 1907. *Calendar 1906–1907*. Cape Town: UCGH and J.C. Juta and Co.

University of Cape of Good Hope (UCGH). 1915. *Calendar 1915–1916*. Cape Town: UCGH and J.C. Juta and Co.

University of the Witwatersrand (WITS). 1922. *General Prospect For 1922.* Milner Park, Johannesburg: WITS.

University of the Cape of Good Hope. 1917. *The Calendar 1917–1918.* Cape Town: J.C. Juta and Co.

University of Cape Town. 1922. *First Graduation Day, December 19th 1922*. UCT

Wolpe, H. (1995). "The debate on university transformation in South Africa: the case of the University of the Western Cape." Comparative Education 31(2): 275-292.

Welsh, David. 2009. *The Rise and Fall of Apartheid*. Johannesburg and Cape Town: Jonathan Ball.