THE SKILLS CLINE: HIGHER EDUCATION AND THE SUPPLY-DEMAND COMPLEX IN SOUTH AFRICA

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Abstract

This paper investigates the relationship between Grade 12 learner preferences for study in higher education, student enrolment in higher education programmes, and student graduations in different programme areas, considering the match between these supply-side indicators and a forecast of skills demand in South Africa as a first step towards ascertaining the extent to which the higher education system is meeting the demand for skills in the labour market. While learner preferences are predominantly for study in the field of Science, Engineering and Technology (SET), student graduations are predominantly in the Humanities. And since a large proportion of scarce-skills areas are SET-related, this creates a mismatch that has implications for the economic development of the country. Simultaneously, however, the demand for educators (school teachers and academics) is even greater: the strongest discrete demand is for educators, followed by that for managers. The paper concludes by urging more concerted development of teachers and managers.

Keywords Higher education; Aspiration; Enrolment; Graduation; Skills

Introduction

In the decade of democracy post *apartheid*, South Africa's exposure to global economic forces compelled the country to greater competitiveness as the gradual de-regulation of the market, the changing shape of the workforce, and the changing nature of work led to a re-evaluation of the skills needed for socio-economic development (see, for example, King and McGrath 2002, pp. 17-31; DoE 2001, pp. 17-18). This paper is concerned with the higher education (HE) supply of skills to the labour market. It considers the extent to which Grade 12 learner preferences are translated into graduations in areas needed for socio-economic development, concluding that the single biggest challenge facing the education and training system is to increase graduate output in selected high-skills areas.

The paper begins by providing a brief review of the literature on learner pathways that provided the initial impetus for the present paper. This is followed by an analysis of the findings of a 2001 survey of Grade 12 preferences with regard to HE fields of study and a comparison of these preferences with the actual enrolment profile one year later. This comparison is then extended to include the graduation profile of students who achieved HE qualifications in 2006. The final section of the paper juxtaposes the preference, enrolment, and graduation profiles with a forecast of scarce skills, showing the disjuncture between skills supply and demand in areas identified as critical for socio-economic development.

Learner pathways from school into and through higher education: A brief review of the literature

The decision to enter HE is a multi-stage process involving a series of successive decisions finally resulting in enrolment in a HE programme (Hossler, Braxton and Coopersmith 1989). Generally, three broad stages can be distinguished in the process:

1. deciding to enter HE
2. selecting a particular institution and programme of study; and
3. persisting in HE (Campaigne and Hossler 1998).

It is the second part of the second stage which serves as a springboard for the present study – the focus of which is not the mechanics of student choice that this line of argument might suggest (for a full account of which, see Hossler, Schmit and Vesper 1999 and Cosser with du Toit 2002) but the relationship between programme preference, programme selection, and programme throughput to and beyond graduation.

Longitudinal studies constitute one of the means of tracking the programme trajectories of cohorts of students through the HE system. In the Australian context, various studies have shown that course change is fairly common in HE. McInnes, James and Hartley (2000) and Walstab, Golding, Teese, Charlton and Polesel (2001) show that 5 per cent to 7 per cent of students change course by May or August of their first year of study – the year in which the greatest amount of transfer between course and cessation of study occurs (McInnis 2001; Williams 1982). McInnes, James and Hartley (2000) report also that 20 per cent of students indicate that they hope to change to a different course after their first year of study. A five-year tracer study of a sample of school leavers (Dwyer and Wyn 2001) discovered that one in four higher education entrants underwent a course change.

Similarly, studies based on the Longitudinal Surveys of Australian Youth (LSAY)[1] have investigated various aspects of course selection and change in Australian schools, VET institutions and universities. McMillan (2005), for example, is able, using LSAY data, to provide a systemic profile – that is, a picture of student trajectories *across the higher education system* and not simply in one institution, as in the previous studies mentioned above – of student flows within the higher education sector. The following diagram illustrates the profile:

[1] LSAY is a programme managed until recently by the Australian Council for Educational Research on behalf of the (then) Australian Government Department of Education, Science and Training but now under the auspices of the National Centre for Vocational Education and Research on behalf of the Australian Government Department of Education, Employment and Workplace Relations.

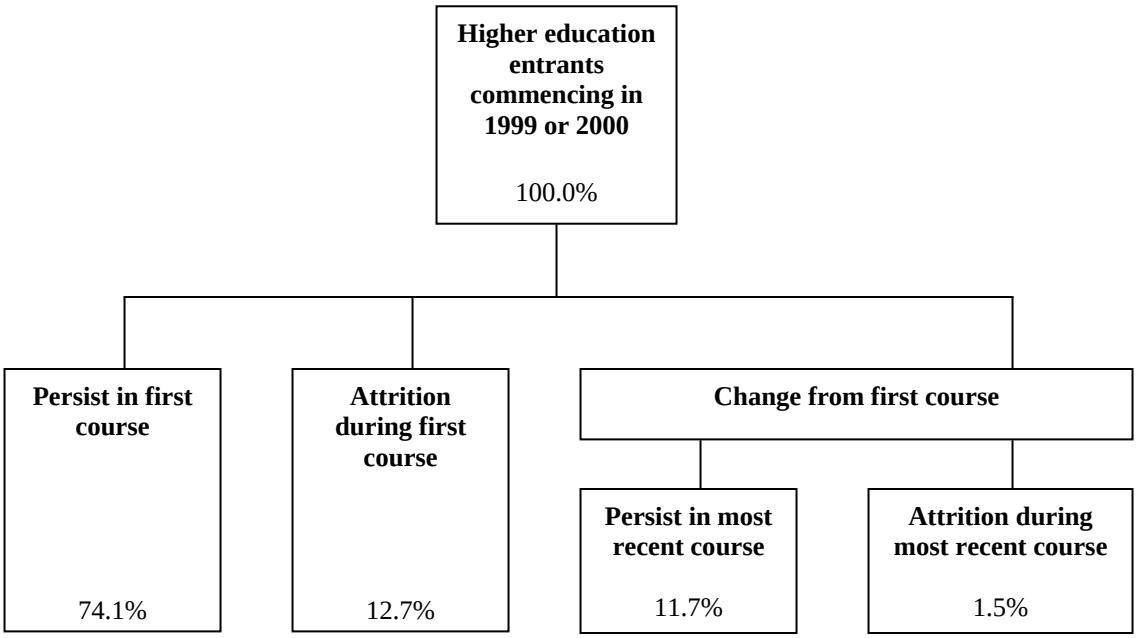

Fig. 1 Student flows within the higher education sector, 1999-2001 (weighted n = 2593) (McMillan 2005, p. 12)

Such findings are confirmed by Marks (2007), who found that, of the young people who enrolled in their first course at a university between 1998 and 2001, 66 per cent had completed that course by 2004, 16 per cent had withdrawn, 11 per cent had changed course, and 7 per cent were continuing. From these figures, the expected completion rate for the first course was estimated to be in the range of 71 per cent to 74 per cent.

What these studies demonstrate is the dual importance of tracing individual students and of tracking student cohorts from one year to the next. All these studies deploy survey-based approaches that use information on samples of students, and each of the studies that spans more than one year analyses, or has the potential to analyse, administrative data covering the entire student population (or a population within a particular higher education institution) as well. In the Australian context, the LSAY study permits an understanding of factors that influence student pathways *and* an understanding of the flow of students from one year to the

next at a systemic level. Similarly, in the South African context the student choice behaviour study (Cosser with du Toit 2002; Cosser with du Toit and Visser 2004) and the Grade 12 learner pathway study (Cosser 2009a; and 2009b forthcoming) combine a focus on individual student trajectories (particularly useful in understanding the factors that influence students in their decision-making) with a system-level understanding of the flow of students from one year to the next.

It is the latter component, which involves analysis of data on preferences, enrolments and graduations at the systemic level, with which the present study is concerned. The critical aspect – from the perspective of this paper – is the extent to which declared intention to enter higher education is translated into student enrolment, and ultimately into student graduation and uptake in the labour market.

Methodology

This paper draws together elements of the Human Sciences Research Council (HSRC) research already conducted into learner aspiration and enrolment with an analysis of student graduations and the results of an investigation into scarce skills in South Africa (Woolard, Kneebone and Lee 2003) in order to make certain points about the efficiency of the education and training system in preparing the future workforce of the country.

The paper juxtaposes the HE programme preferences of the 2001 cohort of Grade 12 learners (Cosser with du Toit 2002), the 2002 enrolment profile of students in HE institutions (Cosser with du Toit and Visser 2004), and the 2006 graduation profile of HE students. The latter juxtaposition (of enrolment and graduation profiles) signals a departure from the crude methodology followed in the calculation of the graduation rate deployed until fairly recently by the Department of Education in South Africa, in which the number of graduations in a year was divided by the number of headcount enrolments *in the same year* (see Subotzky 2003). This calculation is in any event merely a proxy for throughput rate – the number of students completing a programme of study in a given period.

Because degree periods differ – notionally, general first degrees are three years in length and professional first degrees four years in length (with some legal degrees taking five years and architectural and medical degrees taking up to six years) – and because students in the same course take differing lengths of time to complete their study programmes, one needs to fix a graduation year based upon the average length of time a cohort takes to complete a study programme. For the present purposes, this average is deemed to be five years – hence the determination of the graduation year as 2006. An alternative methodology would involve tracking the entire first-year cohort of 2001 to graduation – an exercise which because of the high attrition rate in the HE system (see Letseka 2008, forthcoming), the extent of course change (as outlined above), and the present lack of capacity of HEMIS to provide consistently accurate throughput statistics for every student in HE is beyond the scope of this paper. Hence the decision to adopt a systemic-level approach in which determination of the graduation year involves calculating an average length of time taken to achieve a qualification.

Findings and discussion

The following table sets out the preference, enrolment and graduation (PEG) data on which the subsequent analysis and discussion will be based.

Table 1 Preference (2001), enrolment (2002), and graduation (2006) (PEG) by programme area and field of study (derived from Cosser with du Toit 2002, Cosser with du Toit and Visser 2004, and DoE HEMIS database for 2006)

Programme area	DoE targets	P (2001)*		E (2002)*			G (2006)*	
	%	n^1	%	n^2	%	$(n^2 \div n^1)$ x 100	*n*	%
Natural & mathematical sciences		32,890	10.6	10,391	16.9	31.6	11,792	9.5
Engineering & other applied sciences		71,471	23.1	8,836	14.4	12.4	13,193	10.6
Health sciences		45,318	14.6	3,252	5.3	7.2	9,403	7.5
Business and commerce		100,034	32.3	19,673	32.0	19.7	30,594	24.5
Education		4,415	1.4	1,948	3.2	44.1	28,355	22.7

Social sciences & applied humanities		26,966	8.7	11,879	19.3	44.1	22,921	18.4
Humanities		28,867	9.3	5,498	8.9	19.0	8,424	6.8
Total		**309,961**	**100.0**	**61,477**	**100.0**	**19.8**	**124,682**	**100.0**
Field of study	**DoE targets**	**P (2001)**		**E (2002)**			**G (2006)**	
Science, Engineering and Technology	37.0	149,679	48.2	22,479	36.6	15.0	34,388	27.6
Business and Commerce	33.0	100,034	32.3	19,673	32.0	19.7	30,594	24.5
Humanities[2]	30.0	60,248	19.5	19,325	31.4	32.1	59,700	47.9
Total	**100.0**	**309,961**	**100.0**	**61,477**	**100.0**	**19.8**	**124,682**	**100.0**

***** P = Preference; E = Enrolment; G = Graduation

Learner preferences for higher education study

In 2001, the Research Programme on Human Resources Development (HRD) at the HSRC undertook a survey of 12,204 Grade 12 learners in 288 schools across all nine provinces of South Africa to ascertain their aspirations with regard to entry into HE, the institutions at which those who planned to proceed to HE wanted to study, and the study field preferences of such learners. The survey revealed that 73 per cent of learners planned to enter HE within three years of the survey date (that is, in 2002, 2003, or 2004). However, since this paper is concerned with the third variable – the study preferences of learners – the remainder of the discussion in this section will be devoted to the response profile for this question. (For a full account of the study in its entirety, see Cosser with du Toit 2002 and Cosser with du Toit and Visser 2004.)

The 2001 survey revealed that the vast majority of Grade 12 learners planned to study Business and Commerce at a HE institution within three years of the survey date. The first column in Table 1 presents the study preferences of learners according to the seven programme areas the Ministry of Education uses as the foundation of its "programme grid" for monitoring enrolment trends in HE (DoE 2001, p. 55).

[2] The Humanities field of study combines the three programme areas "Education", "Social sciences and applied humanities" and "Humanities". While the use of the term *Humanities* to refer both to a programme area and to a field of study may be confusing, the discussion below will clarify the referent through the context in which the term is used.

Columns 3 and 4 reveal, besides huge support for studying in Business and Commerce (nearly a third, at 32 per cent), that a sizeable percentage of learners planned to study in Engineering and Other Applied Sciences (nearly a quarter, at 23 per cent). Rather smaller percentages planned to study in the Health Sciences (15 per cent) and Natural and Mathematical Sciences (11 per cent). Besides Education, which a meager 2 per cent of learners planned to pursue, the remaining fields attracted fewer than 10 per cent of learners each.

Aggregated to the three broad fields of study whose balance in enrolments the Ministry of Education (DoE 2001) is keen to shift – from a ratio of 25 per cent Science, Engineering and Technology (SET) to 26 per cent Business and Commerce to 49 per cent Humanities in 2000 to a ratio of 30 per cent to 30 per cent to 40 per cent respectively by 2010 (subsequently revised to a ratio of 37 per cent : 33 per cent : 30 per cent – DoE 2007 – and included in column 2 in Table 1 within the field-of-study rows) – the ratio of these three broad fields to one another is 48 per cent : 32 per cent : 20 per cent. Even given the disjuncture between preference and enrolment, and notwithstanding the fact that only 14 per cent of Grade 12 learners in 2001 actually enrolled in HE institutions in 2002 (Cosser with du Toit and Visser 2004), this ratio suggests that the desired Department of Education ratio may be attainable.

First-year student enrolments in higher education

Encouraging as the depiction in columns 3 and 4 in Table 1 may be, the enrolment profile paints a different picture. One year later (in 2002), the profile of headcount enrolments by study area and field reveals a wide disparity between learner preferences and student enrolments. Columns 5 and 6 depict the 2002 enrolment profile. As column 7 illustrates, there is a large degree of variance between programme areas in terms of the percentages of learners planning to study in them and the percentages of learners who actually enrolled in them. In the case of the Natural and mathematical sciences, this percentage translates to about one third; but in the cases of Engineering and other applied sciences and of the Health sciences, these percentages are much lower (12 per cent and 7 per cent respectively). At the level of field of study, the translation quotient

is much higher for the Humanities as a whole (the last row of the table) – bolstered by high quotients for Education and the Social sciences and applied humanities (both 44 per cent).

At the level of broad fields of enrolment, we see that the enrolment ratio of SET to Business and Commerce to Humanities is 37 per cent : 32 per cent : 31 per cent. This compares with a study preference ratio of 48 per cent : 32 per cent : 20 per cent.

Student graduations from higher education institutions

As we see from columns 8 and 9 in Table 1, just under half of all graduations in HE institutions in South Africa in 2006 were in the field of study of the Humanities. The ratio of Humanities to Business and Commerce to SET graduations, therefore, is not far off the *enrolment* ratio for these three fields which the *National Plan for Higher Education* (NPHE; DoE 2001, p. 1) is keen to shift – away from the Humanities towards the other two fields. How practicable is this policy objective, however?

Before addressing this question, I should point out that there are inherent dangers in the kind of juxtaposition made in Table 1, which may suggest that preference, enrolment and graduation are directly comparable. This is not the case. First, while E and G indicate actual enrolment and graduation figures respectively, P is inferential, representing the number of Grade 12 learners wanting to study in each of the programme areas / fields *generalized from the responses of a stratified, random sample of learners surveyed in 2001*. So P is not of the same order as E and G. Second, P and E are related by virtue of the fact that while E represents the actual number of first-time entering students in 2002 who were in Grade 12 in schools or Further Education and Training Colleges in 2001 and P the inferred number of Grade 12 learners in 2001 who wanted to study in the programme areas / fields in 2002, G is not temporally related to E, representing the total number of graduates from HE institutions in 2006 *across all years of study*, and therefore including students who were in their first year of HE study even before the 2001 survey was conducted.

For these two reasons, direct comparisons of P, E, and G are odious. However, their juxtaposition does provide a broad indication of whether preference is borne out in enrolment and whether enrolment issues in graduation. From Table 1, then, three main observations can be made.

First, a comparison of the number of students wanting to enter HE (309,961) and the number of first-time entering students who were in Grade 12 the previous year (61,477) indicates that only 19.8 per cent of the total number of learners specifying areas of study for which they planned to register enrolled in HE institutions. However, the actual percentage of those who enrolled is even lower (13.7 per cent), since not all Grade 12 respondents to the 2001 survey specified their programmatic preferences. (The number of learners who sat for the Senior Certificate in 2001 was 449,371 – DoE 2003, p. 22.)

Second, as we have already seen, the translation of preference into enrolment differs markedly from one programme area to another *in relation to preferences for enrolment in other programme areas.* While the number of students who enrolled in any one programme area cannot be expressed directly as a percentage of those who wanted to enroll in that programme area, it is evident from column 7 in Table 1 that in both the Social sciences and applied humanities and in Education the translation quotient is nearly a half; in the Natural and mathematical sciences it is a third; in Business and commerce and in the Humanities it is a fifth; in Engineering and other applied sciences it is just over a tenth; and in the Health sciences it is less than a tenth.

And third, at the aggregated level, the table reveals that the relationship between P and G is that of a cline: while the ratio of SET to Humanities preferences is heavily biased towards SET, the relationship of the two to each other balances out at the enrolment stage, while the proportion of graduates in the Humanities far outweighs the proportion of graduates in SET. The following diagram illustrates the relationship:

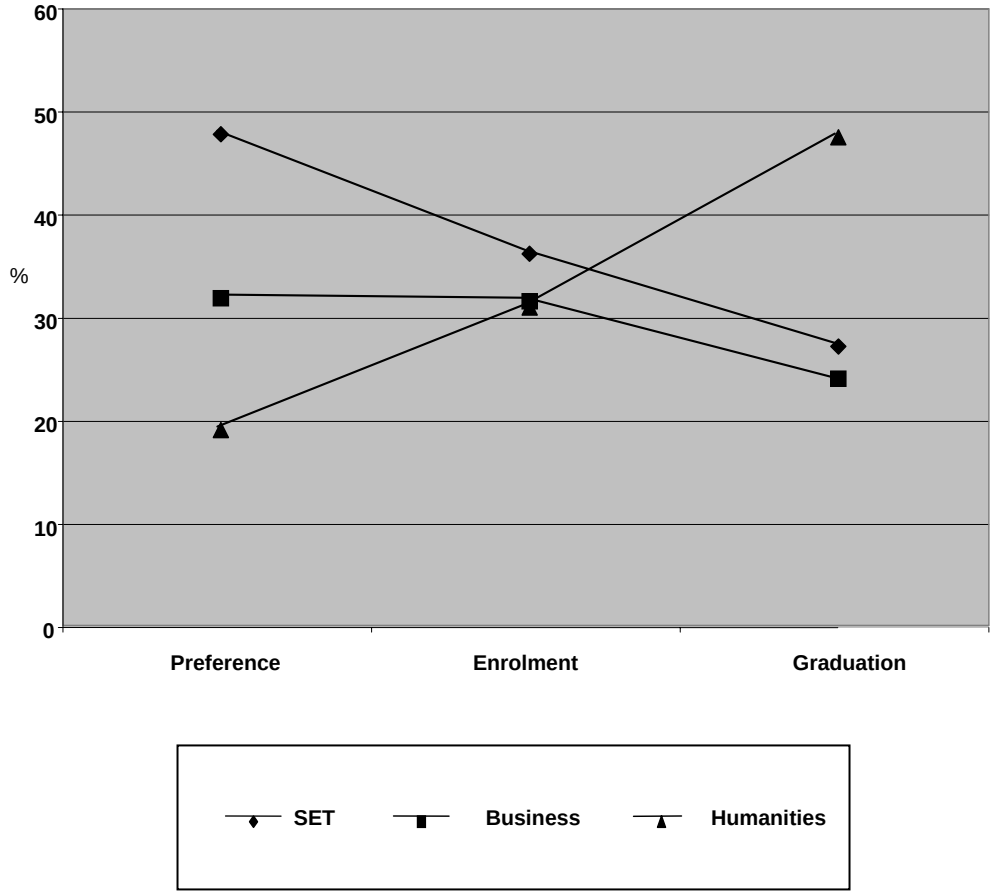

Fig. 2 The SET-Humanities cline

We may infer from this cline one of three things. Either:

1. The drop-out rate in SET is higher than that in the Humanities; or
2. The Humanities absorbs those students who drop out of SET programmes; or
3. The success rate in SET is low in comparison with that in other fields of study.

A combination of two or more of these may even be possible. However, the validity of such inferences would need to be empirically measured. What can be reasonably deduced, from an analysis of average annual inflows into and outflows from the HE system, is the following. About the same number of students enters HE institutions each year directly from school as from other sources. This number, Subotzky (2003, p.359) estimates, is in the region of 65,000. If 130,000 students enroll in first-year programmes and only

90,000 graduate (Subotzky's estimates are based on 2000-2001 HEMIS data), notwithstanding the average five-year time delay between first-year enrolment and eventual graduation, only 69 per cent – or just over two-thirds – of students graduate from the HE system.

From Table 1, moreover, it is evident that while more students enrolled in SET (22,479) than in Business and Commerce (19,673) and the Humanities (19,325) in 2002, the number of graduates in the Humanities (59,700) in 2006 was close to double the number of SET and Business and Commerce graduates (34,388 and 30,594 respectively). In other words, radical shifts take place within the HE system between first-year enrolment and graduation in favour of the Humanities – which seems at first glance to bear out one or more of the inferences made above.

The SET-Humanities cline and the demand for scarce skills

The foregoing discussion has focused on the supply side of the supply-demand equation. In this section, the focus shifts to the demand for skills. What is presented below is the product of a scarce skills forecasting exercise undertaken by researchers at the HSRC for a chapter on scarce skills that appeared in the *HRD Review 2003* (Human Sciences Research Council 2003, pp. 458-474). Table 2 presents the forecast for the occupational demand for selected high-skills occupations.

Table 2 Additional occupational demand for specific high-skills occupations, 2001-2006 (Woolard, Kneebone and Lee 2003)

High-skills occupations	No. in 2001	% average annual change in no. of positions, 2001-2006	Total no. of new positions arising, 2001-2006
Academics	37,237	0.5	914
Doctors	34,740	1.2	2,191
Nurses	155,516	1.2	9,934
Computer-related professionals	75,841	2.5	9,900
Scientists	4,647	1.6	388
Science technologists	4,729	0.5	126
Educators	354,469	1.4	26,417
Engineers	29,824	1.4	2,095

Engineering technologists	32,132	2.1	3,132
Managers	280,298	0.8	11,298

As the table reveals, the demand for engineers (the category includes engineering technologists), natural scientists (scientists and science technologists), and computer-related professionals was expected to be strong – more than 2 per cent per year over the five-year period.[3] This reflects the increasing use of new and more sophisticated technology in all spheres of life. But the demand for professional employment in the public sector was not expected to be strong, mainly because of continued fiscal restraint by government. Thus the categories of educators, medical practitioners and nurses show little growth (1 per cent), that of academics even less (not even 1 per cent).

The final column of Table 2 is possibly of greater relevance from a policy perspective. In particular, the 'little growth' occupation of education is forecast to have the largest number of new positions. Some of the SET occupations for which there will be high demand, on the other hand – such as scientists – will have comparatively few new positions.

The other side of the coin, however, is replacement demand – which, as Table 3 indicates, should be strong as the effect of the HIV / AIDS epidemic escalates and adds to the vacancies created by retirements, emigration, and other causes of mortality.

Table 3 Number of people needed to meet new and replacement demand, 2001-2006 (Woolard, Kneebone and Lee 2003)

High-skills occupations	No. in 2001	No. of workers required to meet new and replacement demand, 2001-2006
Academics	37,237	6,651
Doctors	34,740	5,207
Nurses	155,516	35,461
Computer-related professionals	75,841	15,600
Scientists	4,647	795

[3] This and other percentages cited from this table are rounded off in the text.

Science technologists	4,729	599
Educators	354,469	73,077
Engineers	29,824	5,116
Engineering technologists	32,132	5,973
Managers	280,298	45,130

The demand for nurses, computer-related professionals, and educators is expected to be particularly strong – in each case more than one fifth of the existing number of professionals in these areas. If demand is not calculated as a percentage of the existing number of professionals in any given area, however – nor is there any justification for such a calculation – but through reference to the numbers of workers in the three DoE areas (SET, Business and Commerce, and Humanities) required to meet new and replacement demand, we see that there would be a need for 68,751 SET workers (Doctors, Nurses, Computer-related professionals, Scientists, Science technologists, Engineers, and Engineering technologists in Table 3), 45,130 Business and Commerce workers (Managers), and 79,728 Humanities workers (Academics and Educators). This translates to a SET : Business and Commerce : Humanities ratio of 36 per cent : 23 per cent : 41 per cent.

The demand for skills in the SET field is strong. As Woolard, Kneebone and Lee (2003, p. 473) assert, one of the supply-side interventions needed "to unblock the current skills shortages… [is] increasing the quality of mathematics and science education in the schooling system". Such quality enhancement would, in the short term, have the effect of limiting the number of SET entrants into HE institutions, but ultimately of ensuring that more students who enter SET programmes in HE stay the distance in SET fields and ultimately graduate with SET-related qualifications.

However, as this reclassification of workers according to the DoE study fields shows, the highest demand for workers is in the Humanities. And as the NPHE declares,

> The humanities play an important role, as the White Paper states, in career-oriented training in a range of fields such as education, law, private and public sector management, social development and the arts (White Paper: 2.25). The humanities also play an important role in developing a

> critical civil society through enhancing our understanding of social and human development, including social transformation (DoE 2001, p. 30).

The greatest need in South Africa, the NPHE pronouncements and the HSRC scarce-skills forecasts above suggest, is for well-qualified, motivated educators and managers to assume responsibility for guiding the learners / employees under their tutelage. And since these are the two categories of professional for whom replacement demand will be greatest, it is imperative that the recruitment and development of educators and managers be prioritized by institutions of learning and by public and private enterprises alike.

Conclusion

This paper has made certain assumptions in presenting an argument about the need to increase graduation rates and to steer student choices in the direction of SET. One of these is that a PEG analysis of the kind undertaken here has some validity in indicating the extent to which learner preferences at school translate into student graduations. Another is that matching skills supply and demand is practicable. But both these assumptions are simplistic: it is not possible to provide an accurate picture either of the translation profile or of a neat supply-demand fit. For the former, one would need, minimally, a census of Grade 12 learner preference for study in particular programme areas and fields and a comprehensive picture of the enrolment profile one year later. For the latter, one would need a static education and training system and labour market in which key measurement variables did not alter over an extended period of time (at least five years). The former is theoretically feasible; the latter is impossible. For this reason, I have presented an *indicative* account of changing enrolments and graduations and set this against a demand forecast based on *estimates*.

Nevertheless, the paper has come to some tentative conclusions about the efficiency of the education and training system and its relationship with the labour market. The first is that graduations are a far remove from both learner preferences at school and student enrolments in HE – in terms of numbers (the graduation rate indicates that many students fall out of the HE system altogether) and of study directions (the broad

study field profile is biased towards SET at the preference stage but towards the Humanities at the graduation stage). The second is that the supply profile, as measured by graduations, is out of step with the demand profile, as measured by the forecast for scarce skills over a five-year period. And the third is that, paradoxically, this tension is not problematic for any reason other than that too few learners enter the teaching profession *and stay there* and too few managers are produced both within and outside of the context of the workplace. High-quality teachers are needed to enhance the quality of teaching and learning, especially of Mathematics and Science, while high-quality managers are needed to provide quality leadership in the public and private sectors in South Africa. Without more concerted and intensive skills development in and for education and management, South Africa is unlikely to move up the socio-economic value chain.

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