

A proposal for undergraduate curriculum reform in South Africa:

The case for a flexible curriculum structure

Report of the Task Team
on Undergraduate Curriculum Structure



COUNCIL ON HIGHER EDUCATION

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Discussion Document

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Terms used in this report

Please note: ‘Population group’ and ‘race’: The Task Team does not recognise race as a biological construct that has any bearing on learning, but acknowledges ‘race’ as a social construct that has arisen from South Africa’s history and that continues to be a factor affecting educational opportunities. Thus, in keeping with the convention used by Statistics South Africa, the term ‘population group’ is generally preferred to ‘race’ in quantitative analyses in this report. The group terms are those used by Statistics South Africa.

Articulation: The term ‘articulation’ can be used to refer to the linkage between educational levels, phases, programmes or qualification types. There are thus vertical, horizontal and diagonal forms of articulation. As used in this report, however, the term refers predominantly to educational continuity between consecutive educational levels or phases, i.e. vertical articulation.

(Cohort) completion rate: The percentage of a given student intake, or cohort, that graduates (a longitudinal measure).

Contact institutions: All institutions except UNISA, which offers only distance education. Other institutions also offer some distance or mixed-mode programmes but remain predominantly contact or face-to-face institutions.

Course (or module or unit): In South African terminology, an assessed component of a degree, diploma or certificate programme. In the interests of brevity, the term ‘course’ is used in this report to refer also to modules or units that meet the definition.

Curriculum: The term ‘curriculum’ can encompass many dimensions. As the focus of this report is on the structure of degree and diploma programmes, the term ‘curriculum’ as used here refers primarily to the formal curriculum, that is, the planned learning experiences that students are exposed to with a view to achieving desired outcomes in terms of knowledge, competencies and attributes.

Diplomas: This term as used here refers to the three-year professional or vocational diplomas offered by universities of technology and comprehensive universities; formerly known as National Diplomas.

(Graduate) output and outcomes: The meanings of these terms overlap considerably in common usage. In this report, where a distinction needs to be made, ‘output’ refers to numbers while ‘outcomes’ has a primarily qualitative meaning, referring to the extent, nature and quality of student learning or graduate attributes.

‘Graduation rate’: The number of graduates as a percentage of head count enrolments in a given year. This term is placed in inverted commas since the meaning given to it here is a specialised one used by the Department of Higher Education and Training, and differs from the common understanding of the term as the proportion of a given student intake or cohort that graduates. To

avoid confusion, the term for the latter measure that is used in this report is '(cohort) completion rate'.

Programme: 'A purposeful and structured set of learning experiences that leads to a qualification' (Council on Higher Education 2004).

Provision: The offering of modules, courses or other curricular elements that are intended to contribute to meeting the objectives of a programme (adapted from DHET 2012:5); a generic term for courses and programmes.

Undergraduate: In the interests of brevity, 'undergraduate' refers to diplomas as well as degrees.

Abbreviations

APS:	Admission Point Score
CHE:	Council on Higher Education
DHET:	Department of Higher Education and Training
DoE:	(former) Department of Education
DST:	Department of Science and Technology
ECSA:	Engineering Council of South Africa
FET:	Further Education and Training
GER:	Gross Enrolment Ratio
HEMIS:	Higher Education Management Information System
HEQC:	Higher Education Quality Committee
HEQF:	Higher Education Qualifications Framework
HEQSF:	Higher Education Qualifications Sub-Framework
HESA:	Higher Education South Africa
NBT:	National Benchmark Test
NDP:	National Development Plan
NQF:	National Qualifications Framework
NSC:	National Senior Certificate (first examined in 2008)
NSFAS:	National Student Financial Aid Scheme
SAICA:	South African Institute of Chartered Accountants
SAQA:	South African Qualifications Authority
SET:	Science, Engineering and Technology
STEM:	Science, Technology, Engineering and Mathematics
UNISA:	University of South Africa

Preface

In moments of great historic transitions the world over, extremes of action are normal. Corrective in their intent, they are part of the logic of change. The ascendant power requires “its own people” in large numbers to replace those that had kept going the passing old order. Statistics and quantification of the progress of change carry political import. They can validate or invalidate the new political order. Because they become part of the definition of success or failure, they bear consequences. Woe unto the new order that does not pay attention to them.

In South Africa representation in numbers as an indicator of transformation since 1994 was one of the desired extreme actions. It was one of the requirements to give colour and shape to a new order on the promise that statistical replacement of the old with the new would bring about a future radically different from the past. This was a message of intuition rather than of fact. While intuitions may convey authenticity of intention, they do not go far enough. In fact, on their own, they can be a source of doubt and even disappointment. But such doubts and disappointments can be regarded less as failure than as profound lessons.

This is why the pursuit of numbers partly worked. There was no doubt who wielded political power in South Africa after 1994. But it also became increasingly clear that more was required of people than that each was a number. The numbers needed to go with more.

From a variety of measures, the quality of people bearing a number was also a vital ingredient of their status as citizens. The distinction of a South African citizen will have a great deal to do with the quality of their education; skills they carry as the measure of their competence; the quality of the institutions within which they live and work; the measure of their awareness of the solemn calls of citizenship; and the longevity of their lives to sustain the impact of their contributions to the commonwealth. Such qualities are seldom the product of intuitions. Rather, while they may give expression to intuitions, they are themselves the product of conscious and deliberate effort.

Where the state defines its primary purpose in terms of the quality of its people, and where it supports its intuitions of the future with rigorous effort, its desires will be in synchrony with the required rigour of action necessary to achieve them.

At some point, then, the rigours of the present require more attention than the dreams of the future. The state is likely to succeed where its dreams become embedded in the rigours of the present, informing those rigours, and giving them life and purpose.

This publication is one of an increasing number of signals that South African democracy is entering the second stage of its historic new life. Another signal, by way of example, is the National Development Plan (NDP). Its marked feature is how it diligently critiques a future more evoked than realised in self-conscious effort; a future that keeps receding because it seems to disappear in a murky and unfocussed present severely lacking in human capacity.

The NDP presents the possibilities of a state with a future that is possible only because that state is rigorous in both the ways it thinks and the ways it turns its thoughts into accomplished enterprise. A critical significance of the NDP is its emphasis on rigorous process in the achievement of the

goals of the state. The vision of South Africa in 2030 that it explores and presents requires a rigorous, efficient, yet caring constitutional state.

The ultimate message of the NDP is that no country can live on its aspirations only.

Next to a strong curriculum supporting a basic education system is a sound curriculum undergirding the undergraduate programme. Both levels of education are essentially foundational in the total scheme of things. But undergraduate education, being closer to career systems and life orientation, is through its graduates more decisive in enabling nations to achieve many of their critical objectives.

This study confirms through multiyear undergraduate cohort tracking, that although South Africa has since 1994 witnessed a significant growth in enrolment in both the schooling and higher education sectors, graduate output has not kept pace with the country's needs. High attrition and low graduation rates have largely neutralised important gains in access.

It also highlights the resilience of both historical and systemic factors that have combined to put a brake on the momentum of the desire to craft an undergraduate system that delivers on a demanding constitutional mandate to achieve a successful post-apartheid society. People are always at the heart of such successes or failures. The option to desire success drives educational transformations.

The conditions on the ground dictate a fundamental systemic review of the undergraduate curriculum. More programme time, more flexibility, more system self-awareness, and more rigour and steadfastness around the principles designed to hold the system together are needed. True transformation will occur in the field of teaching itself. The onus on higher educational institutions is to assume greater responsibility for achieving the qualitative transformation reflected in the missions of many, but now requiring their urgent realisation.

Lasting change, against the history of resilient historical factors, will occur more in response to local urgency, and less to external global demands, no matter how significant the latter might be. The universal tends always to be in the particular.

It has been a privilege to work with a remarkable group of South Africans who between them brought together dedicated years of higher education thinking, practice, and leadership. Equally uplifting is the leading scholarship brought to bear on the study and which informed its conclusions.

South Africa may yet have the large numbers she desires and the quality of people to make it a leading country in the modern world.



Njabulo S Ndebele

Chairman: Task Team

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Executive Summary

The focus of the investigation

South Africa has a pressing need for more graduates of good quality, to take forward all forms of social and economic development. It also needs more graduates to build up the education system itself by providing a strong new generation of teachers, college lecturers, academics and education leaders.

However, South Africa's graduate output has been found to have major shortcomings in terms of overall numbers, equity, and the proportion of the student body that succeeds. Despite there being a small intake that has good academic potential, performance in higher education is marked by high levels of failure and dropout. For example:

- Only about one in four students in contact institutions (that is, excluding UNISA) graduate in regulation time (for example, three years for a three-year degree).
- Only 35% of the total intake, and 48% of contact students, graduate within five years.
- When allowance is made for students taking longer than five years to graduate or returning to the system after dropping out, it is estimated that some 55% of the intake will never graduate.
- Access, success and completion rates continue to be racially skewed, with white completion rates being on average 50% higher than African rates.
- The net result of the disparities in access and success is that under 5% of African and coloured youth are succeeding in any form of higher education.

These performance patterns are not compatible with South Africa's need to develop the intellectual talent in all its communities. Moreover, there are no grounds for hoping that the patterns are a temporary aberration. They have not changed significantly since the intake cohort of the year 2000, which was the first to be subject to sector-wide longitudinal analysis; and it is evident that, given the conditions in the education system as a whole, they will not improve without decisive intervention.

It is against this backdrop that the Council on Higher Education (CHE) appointed a Task Team to conduct a comprehensive investigation into a possible intervention. The Task Team was asked to focus specifically on South Africa's current undergraduate curriculum structure as a key element of the teaching and learning process,¹ and to consider the desirability and feasibility of amending it as a means of substantially improving graduate output and outcomes. The reasons for this focus were two-fold. First, evidence of the presence of systemic obstacles to access and success, particularly in relation to curriculum structure, had been accumulated over a number of years. Second, South Africa's current curriculum structure was adopted almost a century ago, during the colonial period, and has remained largely unchanged despite the major changes that have occurred in social and economic conditions. This constituted a *prima facie* justification for a review.

¹ As used in this investigation, the term 'curriculum structure' refers broadly to the parameters of starting level (and related assumptions about students' prior knowledge), duration, the pace and flexibility of progression pathways, and exit level.

This document is the report of the Task Team's investigation and recommendations. On the basis of extensive analysis, the Task Team has concluded that modifying the existing undergraduate curriculum structure is an essential condition for substantial improvement of graduate output and outcomes. The report presents a case for this systemic change, and makes a concrete proposal for a flexible curriculum structure for South Africa's core undergraduate qualifications – based on extending their formal time by a year as the norm – designed to address effectiveness, efficiency, quality and responsiveness to diversity across the higher education sector. Finally, the report provides an analysis of the feasibility of implementing the proposed change, with special reference to its financial and national policy implications. In particular, on the basis of extensive financial projections, the Task Team has concluded that implementing the proposal would be financially viable for the state, would reduce the cost per graduate, and, in short, would be the most efficient, equitable and cost-effective of the available approaches to improving graduate output and outcomes.

The analysis

First phase

The first phase of the investigation focused on **gaining an updated understanding of the undergraduate performance patterns in the sector**. This analysis was based on quantitative data in the form of detailed longitudinal cohort studies of all first-time entering students in the 2005 and 2006 intakes into all three- and four-year degree and diploma programmes. Similar, though less comprehensive, cohort studies had previously been done on the 2000 and 2001 intakes (Scott, Yeld and Hendry 2007), which provided comparative material. The new cohort studies indicate that the broad performance patterns, such as those outlined above, are robust, showing little significant change from those that emerged from the earlier studies.

The conclusions are that the output of higher education is not meeting the country's needs, that the system has low internal efficiency in utilising human and material resources (and consequently does not provide a sound basis for growth), and that the scale of the failure and dropout occurring within a small and selected student body points to substantial systemic problems that require systemic responses. It can be said that, in relation to its educational role, higher education in South Africa is a 'low-participation, high-attrition system' (Fisher and Scott 2011: 1) that has not yet come to terms with its developing-country environment.

Second phase

Recognising that the education system as a whole is a continuum, the second phase of the investigation focused on **identifying and prioritising the systemic obstacles to student success in higher education as a basis for analysing what sectors of the system will be able to play the major roles in ensuring improvement**. The investigation fully acknowledged the effects of material (especially financial) and affective factors on learning, but determined that academic factors are at the heart of the systemic obstacles to student success.

It is widely accepted that student underpreparedness is the dominant learning-related cause of

the poor performance patterns in higher education. It follows that it is the school sector that is most commonly held responsible. However, if higher education is to rely on improvement in schooling to deal with the systemic faults affecting it, there needs to be a rigorous assessment of the prospects of sufficient improvement being achieved within that sector. While the Task Team believes that the level of dysfunction in schooling must continue to be a primary focus of corrective effort, it has concluded that the overwhelming weight of evidence from current analyses of the school sector is that there is effectively no prospect that it will be able, in the foreseeable future, to produce the numbers of well-prepared matriculants that higher education requires.

Similarly, the investigation has concluded that the priorities and capacity of the Further Education and Training (FET) College sector will not enable it to produce a substantial proportion of the well-prepared candidates for higher education that would be needed.

It is estimated that, to be able to operate effectively within its current educational structures and practices, higher education would need between twice and three times as many well-prepared entrants as the pre-tertiary sectors are currently producing (around 100,000 additional candidates). This is not seen as achievable in the foreseeable future.

In these circumstances, a choice has to be made by the higher education sector: between, on one hand, allowing the status quo to persist, and, on the other, undertaking to act on factors that are within its control to address the systemic conditions impeding student success. The report argues that it is both necessary and feasible for higher education to choose the latter path without compromising standards or the academic project.

Third phase

Successfully directing corrective action depends on understanding the nature of the systemic faults affecting higher education. The investigation identified curriculum structure as a key framework that enables or constrains effective teaching and learning in higher education. The third phase of the investigation thus focused on **analysing the role of curriculum structure as a systemic variable affecting student performance**, with particular reference to the availability of sufficient curriculum time and space for necessary reforms.

Student underpreparedness for current programmes is a reality, but underpreparedness is a relative concept: students who are underprepared for a particular educational level may be adequately prepared for another that has different assumptions about prior knowledge. This has important implications for **the first major structural problem to be addressed**, which is discontinuity between secondary and higher education in South Africa. Seeing this problem as an **articulation gap** (DoE 1997: 2.34), rather than just as student underpreparedness, opens up possibilities for positive action within higher education, because a gap can be closed from either side.

The investigation reviewed the key aspects of the secondary-tertiary articulation gap: its origins and longstanding presence, and its complex nature, involving not only subject knowledge but also academic skills and literacies, approaches to study, background or contextual knowledge, and forms of social capital. Considerable knowledge about the articulation gap and how it can be mitigated within higher education has been gained from three decades of experience with

extended programmes in South Africa. Extended programmes provide additional curriculum time for foundational learning to enable students to develop sound academic and social foundations for succeeding in higher education. Extended programmes thus constitute a curriculum intervention designed specifically to address the articulation gap, so they have provided a key source of information for the investigation.

The investigation analysed performance in extended programmes both quantitatively, based on five years of sector-wide student data made available for the first time by the Department of Higher Education and Training (DHET), and qualitatively, using case studies of programmes from individual institutions. The analysis shows that it is possible for the articulation gap to be significantly mitigated by foundational and extended provision, that this improves the completion rates of students from disadvantaged educational backgrounds (especially in SET and other mathematically-based subjects), and that many thousands of students have benefited from this intervention. However, the effectiveness of extended programmes in their current form has been constrained by their marginal status in the sector, which has negatively affected their design, staffing and reach. In particular, because of limited funding, extended programmes can be offered to only a small proportion of the intake, so the large numbers of underprepared mainstream students who are currently struggling and failing are not able to benefit from them.

As the sector-wide performance patterns show, underpreparedness affects the majority of the intake; it cannot be addressed by an intervention for a minority of students. The investigation has consequently concluded that the articulation gap can only be effectively bridged if there is sufficient curriculum space for integrating foundational provision into mainstream programmes for all who need it, and that this requires additional formal time in mainstream undergraduate curricula.

Important though it is, the interface between school and higher education is not the only systemic curriculum fault that needs to be addressed. **The second major structural problem is that, as recent in-depth curriculum analysis has highlighted, many curricula contain key transitions for which students are differentially prepared.** These transitions can be between knowledge domains as well as in various other forms of intellectual demand. Among the valuable pieces of research commissioned for the investigation was the development, by expert working groups, of exemplars of alternative curricula, in five major qualifications, based on the Task Team's emerging proposal for structural curriculum reform. Drawing on recent developments in curriculum analysis, the working groups confirmed the presence of such transitions in existing curricula. The Engineering degree offers a prime example, with transitions in knowledge domain from basic to engineering sciences, to complex problems, design and research, for which students are significantly differentially prepared because of their prior educational and socio-economic backgrounds. In the BCom, key transitions involve 'contextual' knowledge, for example of the broad financial system, that is incorrectly taken for granted in the students and hence is never taught.

As is the case with the entry-level articulation gap, this structural obstacle arises from incorrect assumptions about the prior learning of a large proportion of the student body. The only way of overcoming the obstacle is to put forms of developmental provision in place at appropriate stages of the curriculum. Again, however, there is no curriculum space for doing this in existing

programmes. Moreover, it is evident that dealing with key transitions cannot be done effectively by means of marginal or entry-level foundational provision, but calls rather for coherent curriculum redesign based on realistic assumptions about the diverse student intake. Accomplishing this requires additional formal time.

The third major structural problem is the need for undergraduate curricula to be enhanced in order to meet contemporary local and global conditions. This need is calling increasingly urgently for attention. Enhancement – broadly used in this investigation to mean provision that improves or enriches learning (as opposed to inserting more conventional content) and that goes beyond what is offered in current programmes – is required in a range of forms: from provision that is necessary to support core learning (such as the explicit development of academic literacies), to broadening the curriculum to include learning that is professionally and socially important in the contemporary world (such as additional languages) and that lays foundations for critical citizenship. Again, in the great majority of existing programmes, there is wholly insufficient curriculum space to enable such provision to be incorporated without compromising the integrity of the ‘irreducible core’ of knowledge in the curriculum.

The Task Team has consequently concluded that it is not feasible to substantially improve graduate output and outcomes without extending the formal time of core first degrees and diplomas, in the interests of the majority of the student intake.

Digital educational technology and online learning will no doubt impact increasingly on teaching and learning in higher education. However, the need for sufficient time-on-task will remain, so changes in mode of delivery of undergraduate education will not affect the case for systemic change.

A challenge that is central to South African higher education, and that cuts across the main structural shortcomings of current curricula, is **the need to deal constructively with diversity in students’ educational, linguistic and socio-economic background**. Two key aspects of the student intake profile are relevant here.

- Analysis of the national performance patterns indicates that the majority of the current student intake stand to benefit from the proposed structural curriculum reform. The large numbers who fail or drop out for learning-related reasons would clearly benefit; and the many who take longer than the current regulation time to graduate – often with only marginal passes – would not be disadvantaged and the quality of their studies would most likely be substantially improved. These two categories constitute a majority of the current intake, and their proportions are likely to increase with enrolment growth.
- At the same time, an appreciable minority (27% of contact students in the core degrees and diplomas) currently graduate in regulation time. For reasons of educational effectiveness and efficiency, cost to the state and equitable use of public funding and resources, the Task Team has concluded that students who are able to graduate in less than the proposed new formal time should be permitted to do so.

The data show that moving from the current rigid curriculum structure to another rigid one would not satisfactorily address the diversity that will continue to characterise the student body, and

would be likely to dilute resources that should be focused fully on addressing inequality and inefficiency. What is required instead is a **flexible curriculum structure** that establishes new mainstream parameters of duration, starting point and progression pathways – allowing for coherently-designed curricula that meet the needs of the majority – and that also makes provision for shorter pathways within the new norms.

In considering the academic desirability and feasibility of the flexible structure it envisages, the Task Team has examined its implications for the key matters of academic standards, institutional autonomy, system growth, and capacity to reduce individual and institutional inequalities. It has identified no significant drawbacks but rather some important advantages, as set out in the report.

The Task Team therefore proposes the introduction of a flexible undergraduate curriculum structure, as summarised in the next section.

Fourth phase

The fourth phase of the investigation focused on a comprehensive analysis of the viability of the Task Team's proposal in practice, in terms of cost to the state and the students, implications for higher education policy and regulation, academic staffing, and institutional responsibilities. The findings of this analysis are outlined in the latter sections of this summary.

The proposal

On the basis of the analysis outlined above, and in order to meet the goal of improving graduate output and outcomes for the full range of the student body, the Task Team proposes the introduction of a new undergraduate curriculum structure with the following three fundamental elements:

Duration: To meet the needs of the majority of the student intake, the formal time of all current three-year degrees and diplomas, as well as current four-year professional Bachelor's degrees at level 8 of the Higher Education Qualifications Sub-Framework (HEQSF), should be increased by one year. The policy amendments needed to provide for this change are the allocation of an additional funding unit in HEMIS and an additional 120 HEQSF credits to the minimum credit value of each of the qualification types concerned.

Flexibility: To provide effectively and fairly for diversity in preparedness, the new curriculum structure should be flexible to allow students who can complete a programme in less than the formal time to be permitted to do so. The main mechanism for this will be that students who can demonstrate the necessary knowledge and skills, through meeting rigorous and transparent criteria, can be granted exemption for some or all of the new first-level courses.

Standards: To ensure the maintenance or improvement of the standards of qualifications, curricula in the new structure should retain or improve upon existing exit standards through utilising the additional curriculum space afforded to ensure realistic starting points and progression paths, and to introduce valuable forms of curriculum enhancement. The additional curriculum space must not be used to increase the volume of conventional content, as this would defeat the purposes of the proposal.

The development of curriculum exemplars, referred to above, played a key iterative role in finalising the proposal. The exemplars were based on the essential elements of the proposal and confirmed that all these elements were practicable. In addition, the exemplar working groups endorsed the proposed new structure as a necessary framework for improving graduate output and outcomes. At the same time, the exemplars served to deepen the Task Team's understanding of key issues – including the nature of underpreparedness in different disciplines and the need to re-structure mainstream curricula as a whole – and thus informed the refinement of the proposal into its final form. The exemplars are included in this report in Appendix 2.

Implementation: Financial implications

There is likely to be a perception that adding a year to the formal time of qualifications would lead to a considerable increase in costs to the state and the students, but this view does not take account of the extremely high cost of failure and inefficient use of resources in the sector at present, which the state and the consumers are already having to bear. To resolve this matter, and in accordance with its brief, the Task Team regarded it as critical to examine the financial implications of the curriculum proposal in depth. It thus commissioned an extensive analysis of the current costs to the state of the core qualification types under investigation, as well as projections of costs and related resource matters for the proposed curriculum structure. It also considered two other possible scenarios for improving graduate output.

The analysis and projections were used to address two key questions.

- Since affordability is central to the feasibility of the proposal, the first question is: **What would be the additional direct costs to the state, in terms of subsidy and NSFAS contributions, of implementing the proposal put forward in this report?** To answer this question, it was necessary for the projections to be based on quantified assumptions about the improvement in throughput that is expected to result from the new structure because of its responsiveness to the realities of students' prior learning. These assumptions were calculated on the basis of the national performance patterns and data on extended programmes. The scenario reflecting the flexible curriculum proposal is referred to as **Scenario 1**.
- Since there is now an explicit national commitment to substantial expansion of higher education, as expressed in the National Development Plan and the Green Paper, growth in graduate numbers has become a priority. The second question is therefore: **What would be the comparative cost, to the state and the students, of different approaches to improving graduate output?** Other than improving the performance patterns (as reflected in Scenario 1), the only way to increase graduate output is to increase the student intake. Consequently, two increased-intake scenarios were also developed: **Scenario 2a**, which assumes that the additional intake would perform as well as the present total intake; and **Scenario 2b**, which assumes that, since the additional intake would have a significantly lower profile of educational attainment than the present one, the additional students would have a lower average level of performance in current curricula than the present total intake.

The **findings** of the analysis of the scenario projections include the following:²

Comparison between the proposed new structure and the status quo

In practice, increasing graduate output will inevitably carry additional cost. However, the projections show that the flexible curriculum structure (Scenario 1) outweighs its additional costs with increased graduate output.

- For each entry cohort, with the same student intake as at present, Scenario 1 would cost 16% more in subsidy than the status quo but is projected to produce 28% more graduates (about 15,000). The cost per graduate would be reduced by 10%. (There would be a similar reduction if NSFAS funding were included). This would be the result of the better throughput, and hence cost-effectiveness, expected from the new structure.
- In the steady state, once four student cohorts had flowed into the new structure, the total average annual additional subsidy required for Scenario 1 would be R716 million. This represents only 5.3% of the comparable subsidy amount for 2012, a modest amount for producing the additional graduates noted above.
- The new structure would remove the need for extended programmes in their present form and hence the need for the Foundation Grant, which has a current allocation of about R200 million per annum. Putting this funding towards subsidy for the new structure would significantly reduce the additional outlay required. Moreover, if funding from the Teaching Development Grant – which has similar goals to those of the new structure and a current annual allocation of over R500 million – were partly or mainly redirected to subsidy, much or even all of the additional outlay could be met.

Comparison across the scenarios

Despite the additional year of formal time, the projections indicate the financial advantages of the improved performance patterns of Scenario 1 in all the respects considered, for example:

- The subsidy cost per graduate is about 10% higher in Scenario 2a than in Scenario 1, and nearly 20% higher in Scenario 2b.
- The additional subsidy cost of producing 15,000 more graduates is 69% higher in Scenario 2a and 138% higher in Scenario 2b than in Scenario 1. Over a full cohort period, the total additional cost of Scenario 2b over Scenario 1 for one cohort is approximately R1.8 billion.
- The current costs of inefficient and wasteful use of resources in the system are high. In relation to the status quo, Scenario 1 reduces the unproductive use of subsidy (defined as subsidy spent on students who do not graduate within the subsidy period) by 25%. In contrast, in producing the same number of graduates as Scenario 1, Scenario 2a increases unproductive subsidy expenditure by 28%, and Scenario 2b by 50%.
- Since infrastructure needs are linked to enrolments, Scenario 1 would have a beneficial effect on containing infrastructure costs by improving the ratio between expenditure and the number of graduates produced.

² All amounts are given in 2012 rands. UNISA is excluded throughout because of differences in its funding model.

Cost to the students and their families or sponsors

Because the large majority of students are already taking longer than the regulation time to graduate, and are having to pay for this, the projections indicate that in the new structure the student body would on average have the same outlay for higher education as is the case now. It is likely that some students would have a higher outlay, for reasons such as incorrect placement; however, a greater number would pay less or, more importantly, achieve a qualification rather than dropping out and losing their investment.

Academic staffing: resources and workloads

The availability of adequate staffing, in terms of numbers and expertise, is clearly essential for implementing the new structure, and in fact any other approach to improving graduate output and outcomes. Moreover, there are likely to be concerns among academic staff that additional formal time for core qualifications would result in increased workloads. The analysis undertaken on this issue indicated the following:

- Although subsidy covers various costs besides staffing, the three scenarios would all generate enough additional subsidy to enable current student-staff ratios to be maintained. However, Scenario 1 would require only 14% more funding to achieve this, whereas Scenarios 2a and 2b would require nearly double and treble the increase respectively. The latter scenarios would therefore place greater pressure on the fiscus and hence reduce the probability of there being sufficient funding for staff.
- The feasibility of improving student-staff ratios, to levels recommended by the institutions, was also examined. The projections showed that achieving this as well as graduate growth would be expensive, but that Scenario 1 offered the least costly approach.

The **overall conclusion** of the analysis is that implementing the new structure would be financially viable, and would constitute the most resource-efficient way of achieving substantial graduate growth.

Implementation: Implications at national and institutional level

Policy implications

The investigation has found that the national higher education policy implications of implementing the new structure would be relatively minor and manageable. They include the following:

- As noted above, financial provision would have to be made by allocating an additional funding unit to each of the qualification types included in the proposal.
- The Higher Education Qualifications Sub-Framework (HEQSF) does not contain any significant barriers to implementing the new structure; in particular, it does not specify maximum credit values or the duration of a programme. It would be necessary, however, for the minimum total credit value of the programmes affected to be changed to reflect the new norm of an additional 120 credits, and to include provision for a maximum of 120 credits from which students may be exempted on the basis of their demonstrated level of

preparedness.

- There are strong positive incentives for institutions to improve student performance through introducing the flexible curriculum structure. However, the Task Team has recognised that there is a possibility that the new structure could be manipulated (for example, for institutional marketing or recruitment purposes) in ways that would defeat its purposes. It is therefore necessary for regulations to be formulated to ensure that all higher education institutions – private as well as public – fully implement the new structure in a responsible way. Various mechanisms, including the national accreditation and quality assurance systems, can be used to ensure this.
- A key means of safeguarding both the integrity and the educational effectiveness of the new structure is placement policy: that is, the principles and mechanisms for permitting students who can demonstrate a high level of preparedness to follow a shorter curriculum pathway through exemption from some courses. This approach, a variant of Recognition of Prior Learning (RPL), is central to the flexibility of the curriculum structure, but it is essential that it be applied rigorously and transparently, in the best interests of the student. Regulation, at system level and in individual institutions, must thus ensure that the criteria or assessments on which the granting of credit exemption is based are valid, objective and consistent. The fundamental test to be applied to placement decisions is what path will maximise the individual student's probability of succeeding in the programme concerned.
- The Task Team recommends that the new structure be introduced as soon as possible, with the DHET setting a specific starting date and co-ordinating a well-planned transition strategy.

Institutional responsibilities

Detailing an implementation process is beyond the brief of the investigation but the report offers notes on the main opportunities and responsibilities envisaged at institutional level. At the heart of these would be curriculum and course design, the development and implementation of educationally sound placement policy and mechanisms, and continuing development of effective teaching and learning approaches and student and staff support systems.

National support mechanisms

The Task Team recognises that, particularly as the higher education sector has experienced much policy change over the last decade, the readiness as well as the capacity of the system to undertake curriculum reform is a key consideration. The process of implementing the new structure would therefore be greatly facilitated by commitment and support for the institutions at national level. The key recommendations in this respect are the following:

- The central implementation process will need to incorporate administrative and financial planning, liaison with and support for the institutions, and liaison with other stakeholders, including student and professional bodies. The Task Team recommends that the DHET, in consultation with the CHE and HESA, consider establishing a dedicated transition unit for a specified period, to provide leadership, co-ordination and support for the process – perhaps along the lines of the Merger Unit that oversaw the recent institutional mergers and incorporations.

- Improved retention rates will lead to increased enrolment. While institutions will have some time to adjust to this, there should be compensation for the two-year lag between enrolment growth and the payment of the teaching input subsidy that will fund it. There will also be non-recurrent costs involved in the initial curriculum and course design work required in the implementation period. It is therefore recommended that a temporary earmarked transition fund be established to support the implementation process, to be managed by the proposed transition unit.
- It is recognised that educational design and pedagogy that are effective for South Africa's diverse student body are essential for taking full advantage of the flexible curriculum structure. Improving educational expertise and the status of teaching in higher education is an essential complement to structural curriculum reform, and is a goal that will need to be pursued for the foreseeable future. In the shorter term, implementation of the new structure would require a period of concentration on curriculum and course design, and a consequent need to develop expertise in this area across the sector. The Task Team therefore recommends (a) that the DHET consider directing a substantial proportion of the Teaching Development Grant towards building capacity in curriculum development during the implementation process, and (b) that the DHET, CHE and HESA consider establishing a small national unit (possibly reporting to the proposed transition unit) to lead and co-ordinate professional development work in this area, utilising existing expertise in the sector, for a period of five years.

Conclusion

In response to the essence of its terms of reference, the Task Team has concluded that introducing a flexible curriculum structure, as proposed in this report, is an essential condition for improving the output and outcomes of higher education, with wide-ranging advantages that would justify the effort required to implement it. The benefits of the change would be expected to reach a wide range of constituencies. Most importantly, the country as a whole stands to benefit from the projected improvement of quality and equity in the graduating class, in terms of economic and social development and social cohesion. For this reason, the Task Team believes that replacing the existing, inherited curriculum structure with the proposed new structure, and thus providing an enabling framework for undergraduate teaching and learning that is based on South Africa's realities, would represent a significant step in the transformation of higher education.

Finally, the Task Team believes that its investigation has shown that implementing the flexible curriculum structure is feasible, and is the most educationally sound and cost-effective of the possible options for systemic reform.

1. Introduction

Chapter Overview

This document constitutes the report of the Council on Higher Education's Task Team on Undergraduate Curriculum Structure, which was convened to investigate the appropriateness of the broad curriculum structure of South Africa's core undergraduate qualifications. The investigation arose from a growing concern about undergraduate performance in higher education, and the Task Team was mandated to make recommendations on possible systemic reforms with a view to improving graduate output and outcomes. Chapter 1 sets out the background to the commissioning of the investigation, the composition and terms of reference of the Task Team, and the purpose and status of this report.

The Task Team was asked to investigate the implications of a possible change in the duration of undergraduate qualifications for, *inter alia*, the maintenance of exit-level academic standards, for improving learning within a student body that encompasses varied levels of educational preparedness, and for promoting graduate attributes needed in the contemporary world. The Task Team was also asked to examine the implications of such a change for staffing needs, for national systems such as HEMIS and the funding framework, and, most importantly, for financial efficiency and sustainability.

The report represents the conclusions of the Task Team, and does not necessarily reflect the views of the Council. The report and its proposals and recommendations are put forward for consideration and comment by the higher education sector and its stakeholders. The consultation process will inform the formal advice on this matter that the Council will present to the Minister of Higher Education and Training.

1.1 Background to the investigation

The promotion of 'equity of access and fair chances of success to all who are seeking to realise their potential through higher education, while eradicating all forms of unfair discrimination and advancing redress for past inequalities' is a central goal of the policy framework for the transformation of the higher education system, as outlined in Education White Paper 3: *A Programme for the Transformation of Higher Education* (DoE: 1997: 1.14). However, the 'revolving door' syndrome, in which increased access is accompanied not by success but by high failure, repetition and dropout rates, continues to characterise the higher education system. While steady progress has been made since 1994 in addressing equity of access, equity of outcomes remains elusive. Thus a key strategic objective – to produce increasing numbers of graduates with the skills and competencies to meet the human resource and knowledge needs of the country – remains unfulfilled.

A major underlying reason that has been identified for the disjuncture between access and success is the mismatch between the demands of higher education and the preparedness of

school-leavers for academic study. It is widely accepted, and the White Paper recognises, that in the long term, improvement in equity of outcomes is dependent on enhancing the quality of schooling. However, the White Paper argues that in the shorter term the identified mismatch or ‘articulation gap’ has to be addressed by higher education institutions through a comprehensive and multi-faceted approach which should include, but not be limited to, the provision of foundation and extended curriculum programmes. Indeed, it argues that given the extent and persistence of the shortcomings in schooling, what is required is nothing less than ‘systematic changes in higher education programmes (pedagogy, curriculum and the structure of degrees and diplomas)’. In this regard, the White Paper states that the Ministry will, in co-operation with the CHE:

initiate a thorough review of the structure and duration of degree, diploma and certificate programmes, aimed at achieving a more appropriate fit between the school, or (more broadly) further education and training, and higher education systems. The review will necessarily entail an assessment of the broad curriculum in higher education in terms of content, relevance, design and delivery (DoE 1997: 2.35).

Although there has been considerable expansion of access and foundation programmes – in particular, extended curriculum programmes, since state funding for such programmes came on-stream in 2004 – there has been no formal systemic curriculum review as envisaged in the White Paper.

The CHE ‘Shape and Size’ task team, in its report *Towards a New Higher Education Landscape: Meeting the Equity, Quality and Social Development Imperatives of South Africa in the 21st Century* (CHE 2000), proposed the introduction of a ‘four-year first bachelor’s degree’ in response to both high dropout rates and changing knowledge needs. The report proposed that:

The first two years of the four-year first bachelor’s degree could provide for the development of required generic and foundation skills and include some broad discipline and multi-discipline based knowledge. Years three and four of the degree could include a strong emphasis on single discipline and multi-discipline based specialization, including an introduction to elementary forms of investigation and research methodology. The implication of and relation between the four-year degree and the existing Honours qualification would need to be examined (CHE 2000: 47).

In its response to the CHE in the *National Plan for Higher Education* (DoE 2001), the then-Ministry of Education supported the CHE’s proposal to investigate the introduction of a four-year undergraduate degree. However, this was not pursued on the grounds that, given the introduction of a range of new policies and processes, including a new funding framework, the restructuring of the institutional landscape and the introduction of a quality assurance system, further policy changes would be too onerous for institutions.

Subsequently, in 2008, the *Report of the Ministerial Committee on Transformation and Social Cohesion and the Elimination of Discrimination in Public Higher Education Institutions* supported

a review of the undergraduate qualification structure as one of the means of addressing structural obstacles to student equity:

The Committee welcomes and supports the review of the current undergraduate degree structure to assess its appropriateness and efficacy in dealing with the learning needs of students, given the context of schooling in South Africa, and given the acknowledged gap between school and higher education, which the Minister has requested the CHE to undertake. The review should, in particular, consider the 'desirability and feasibility' of the introduction of a four-year undergraduate degree..... [This] would include reviewing the role of academic development programmes and their integration into a new four-year formative degree (DoE 2008: 73).

The continued disjuncture between increased access and academic success was highlighted by the Minister of Higher Education and Training at the Higher Education Summit in April 2010. The Minister noted that, while the reasons for this are multi-fold and include inadequate funding, poor student accommodation and poor schooling, institutions would have to adapt their 'curriculum and teaching strategies to suit the student population that we have' as 'we are not likely to get a radically different type of student anytime soon'. The solution, he pointed out, would have to be based on 'curriculum reform and the expansion of student support programmes' (DHET 2012b).

This was re-iterated in the *Green Paper for Post-School Education and Training*, which states:

Inadequate student preparedness for university education is probably the main factor contributing to low success rates. Various approaches have been attempted by different universities to compensate for this problem. Unfortunately, there is no clear evidence of what the most successful routes are. Clearly, though, universities will have to continue to assist underprepared students to make the transition to a successful university career. This could involve foundation programmes, intensifying tutorial-driven models which enable small-group interaction, or increasing the duration of degrees. The funding system must support such initiatives. Universities and programmes differ in their student intakes, and each must tailor their support offerings to fit their needs (DHET 2012a: 42).

It is against this backdrop that the CHE established a Task Team to investigate the desirability and feasibility of restructuring the current three- and four-year undergraduate degrees and diplomas and extending their duration, as a mechanism for both enhancing academic success and enabling students to engage with the changing role of knowledge in contributing to social and economic development in the 21st century.

1.2 Composition and Terms of Reference of the Task Team

The Task Team was chaired by Professor Njabulo Ndebele and comprised the following additional members:

Ms Nasima Badsha
Professor Brian Figaji
Professor Wieland Gevers
Professor Barney Pityana.

Professor Ian Scott co-ordinated the associated research and the development of the report. Mr Ahmed Essop and Dr Denyse Webbstock represented the CHE on the Task Team.

The Terms of Reference of the Task Team (see Appendix 1 for full details) were to investigate the following matters, guided by the principles and goals of the transformation of the higher education system as outlined in the White Paper and the National Plan for Higher Education:

1. The restructuring of the duration of the three main undergraduate qualifications in the Higher Education Qualifications Sub-Framework (HEQSF):
 - 3-year diplomas
 - 3-year Bachelor degrees
 - 4-year professional degrees.
2. The curriculum implications of restructuring in terms of both breadth and depth and entry-level and exit-level standards.
3. The implications of changing the norm in terms of duration for students whose prior educational background would enable them to complete their studies successfully within the existing undergraduate qualification structure.
4. The potential for curriculum reform linked to graduate attributes in the context of a changing world – national, regional and international.
5. The implications of restructuring the undergraduate qualifications for postgraduate qualifications, in particular, the postgraduate diploma and the honours degree.
6. The implications for staffing, particularly in relation to workloads.
7. The financial implications in terms of affordability and sustainability, including the implications for the National Student Financial Aid Scheme (NSFAS).
8. The technical implications in relation to the HEQSF, the Higher Education Management Information System (HEMIS) and the funding framework.
9. The identification of the key elements necessary for the successful implementation of any proposed changes to the structure of undergraduate qualifications.

1.3 Purpose and status of the Report

This report is the outcome of the investigation undertaken by the Task Team. In accordance with the terms of reference, it gives an account of its analysis of the appropriateness of the broad curriculum structure of South Africa's core undergraduate qualifications, and proposes the introduction of a flexible curriculum structure to address the challenge of improving graduate output and outcomes, with recommendations on the implementation implications.

The report addresses the Task Team's terms of reference in broad terms. In the course of its work, the Task Team decided to concentrate on the essence of its brief by analysing and reaching a firm view on the overarching issue of the effectiveness or otherwise of the current undergraduate curriculum structure for contemporary South African conditions, and making recommendations accordingly. This has been achieved, with consensus having been reached on the need for decisive and substantial systemic change and the form that the change should take. The underlying argument is comprehensive, and the recommendations are as concrete and specific as is deemed appropriate at this stage.

The Task Team recognised that the nature of its findings was such that recommendations on the more detailed matter of the implications for postgraduate qualifications, particularly the postgraduate diploma and the honours degree, would be premature. It likewise recognises that if its proposals for the restructuring of undergraduate qualifications are accepted in principle, more detailed technical work will be necessary to ensure successful implementation.

The Task Team would also like to indicate that although its terms of reference required it to consult with the higher education sector, it did not do so, believing it more appropriate and constructive for consultation to follow the release of the Task Team's report, which would enable substantive engagement with its findings and recommendations. This was agreed to by the Council, which has indicated that it will release the Task Team's report for consultation, and that the outcomes of the consultation process will inform the advice that the Council will provide to the Minister of Higher Education and Training on the desirability and feasibility of restructuring the core undergraduate qualifications.

The Task Team believes that acceptance of its proposals will facilitate a significant step forward in the transformation of higher education in South Africa, and welcomes responses from all interested parties.

2. Problem statement: The need to improve graduate outcomes and output in South Africa

Chapter overview

This chapter sets out the main problem this investigation seeks to address. It argues that the South African higher education system is currently producing too few graduates, both in absolute numbers and relative to intake, and that there are mismatches between current graduate attributes and the broader needs of society and the economy. It posits that a major fault-line is a discontinuity between school and undergraduate studies in higher education, referred to in this report as an articulation gap. This gap is manifest in undergraduate programmes that are based on inappropriate assumptions about students' prior knowledge, that are inflexible in terms of learning pathways, and that do not take sufficient account of students' differing educational preparedness to bridge transitions between various phases of undergraduate study.

The main proposition of the report is introduced: that is, that the current parameters of undergraduate curriculum structure are not enabling the main goals of higher education to be fully achieved, and that more curriculum space is needed to produce more graduates with appropriate attributes for the changing needs of South African society.

2.1 Introduction: The need to improve graduate output and outcomes

The challenge that this investigation addresses is that there is a pressing need to increase the numbers of graduates in South Africa who are well-prepared for the changing demands of society and the economy. Graduates are required for their disciplinary and professional expertise and for creating jobs, and there are key elements of development that cannot be achieved without them. However, the need for more people with advanced knowledge and competencies, as well as an informed understanding of the contemporary world, goes beyond the demands of economic development and technical skills shortages into all key areas of the country's well-being, including social cohesion, cultural growth and the maturation of South Africa's democracy through responsible citizenship.

Representivity among graduates, in terms of race, gender and social class, is essential for equity, for developing the talent across the population, for setting a balanced development agenda, and for maintaining the public's respect for and faith in higher education. Moreover, graduates from all communities are essential for building the school and college sectors, on which South Africa's social stability greatly depends. To complete the circle, there must also be a strong and diverse core of academically-orientated graduates to widen the pipeline into postgraduate studies and to produce the next generation of academics in order to build research and teaching capacity in the higher education sector itself.

The need for more graduates is expressed, directly or indirectly, in ambitious long-term targets for higher education expansion in both the *Green Paper for Post-School Education and Training*

(DHET 2012a) and the *National Development Plan* (NPC 2012). The Green Paper calls for total university enrolment to rise to 1.5 million by 2030 from approximately 900,000 in 2011 (DHET 2012a: x). The National Development Plan has a similar target for 2030 of 1.62 million enrolments, and goes further to call for 400,000 graduates a year by that date, up from about 150,000 at present, with significant increases in the science, technology, engineering and mathematics (STEM) areas (NPC 2012: 317,319).

There are, however, major obstacles in the way of achieving these national targets as well as the broader goal of raising the overall level of 'educatedness' in the country. Analysis of higher education performance in recent years has shown serious shortcomings in graduate output and outcomes, including the following:

- Low student success and throughput rates, leading to low absolute numbers of graduates.
- Uneven and often unsatisfactory graduate quality, not only in disciplinary or technical expertise but in graduate attributes that are widely seen as necessary for the contemporary world. As the National Development Plan puts it: 'For the increase in the number of graduates to be meaningful, the quality of education needs to improve. ... The data on the quality of university education is disturbing' (NPC 2012: 317).
- Equity of outcomes. The distribution of graduates continues to be highly skewed along racial lines. The interlocking conditions of low output and lack of equity have a major effect on all forms of development.

The effects of the status quo have severe consequences for many individuals as well as the country as a whole. To quote the Green Paper, the high university attrition rate 'represents a distressing blow to the ambitions of tens of thousands of drop-outs each year', for many of whom education is the only available means of advancement and mobility (DHET 2012a: 41). Thus graduate production must be assessed in terms of quality and equity as well as numbers.

Given the large proportion of students who enter but drop out of higher education in South Africa, a question that arises is to what extent incomplete studies may have value; that is, whether there is any evidence of people's lives having been improved as a result of passing some courses at university without graduating, compared with others who have had no exposure to university education at all. There are no ready ways of measuring the effects of educational experiences on people's inner lives but there are some indicators relating to material life-chances, such as the following:

- There has been some South African research indicating that people with some tertiary education experience have a better chance of employment than people with only a 'matric' or a National Senior Certificate, but official data and comprehensive studies are scarce. In its Quarterly Labour Force Surveys, Statistics SA does not distinguish between people with 'matric' and those with incomplete tertiary qualifications. There is, however, abundant evidence of the employment differential between those with matric as their highest formal qualification and those with tertiary qualifications. For example, in terms of unemployment, the Quarterly Labour Force Survey for Quarter 4 of 2012 shows that over the years 2010-2012, about 6% of the unemployed had a tertiary qualification, compared with about 33% with matric (Statistics SA 2013: xv). Recent research by the Centre for Development and

Enterprise indicates that degree-holder unemployment decreased from 8% in 2001 to 5% in 2011 (CDE 2013: 8).³ Similarly, people with a tertiary qualification, of whatever kind, have a high probability of being employed: 'For those with tertiary qualifications the employment to population ratio ranged from 79% to 84% amongst the different racial groupings' (Lehohla 2010). An indicator of the demand for graduates is that 'degree holders in the labour market grew from 463,000 in 1995 to 1.1 million in 2011' (CDE 2013: 1;8).

- In terms of the differential between graduates and people with incomplete tertiary qualifications, a recent quantitative study provides a clear picture of the advantages enjoyed by those who complete their studies. In terms of employment, Bhorat, Mayet and Visser (2012) conclude that 'overall, the unemployment rates are much higher for non-completers than for graduates' (ibid.: 11). Similarly, in terms of earnings, 'Outcomes in the labour market suggested, as expected, a poorer performance of non-completers relative to graduates, consistent across race, institution and field of study' (ibid.:16). The study showed that, averaged across all fields of work, the mean monthly earnings of graduates were at least double those of non-completers (ibid.:15).

The Task Team recognises that completing a higher education qualification is likely to have value beyond the instrumental. For example, it might be argued that achieving a degree indicates an ability to complete a major and challenging undertaking over a multi-year period. Meeting degree standards is also an indication of overall, holistically assessed academic achievement that has significance for many aspects of life and work – for the graduate's sense of self as well as life chances.

The Task Team consequently affirms that the problem it was constituted to address is the structural obstacles that are standing in the way of large numbers of students' completing their studies. The investigation's specific focus on improving graduate output and outcomes is justified by the far-reaching effects of the shortcomings of the status quo on the availability of people with advanced qualifications, on the general level of education of the country's population, and on individuals' personal development and life chances.

The investigation has concentrated on the higher education sector itself. It is recognised that the performance of the sector is strongly influenced by factors beyond its control, such as schooling and socio-economic realities, and this investigation has examined these factors. However, producing graduates is solely the responsibility of higher education, which consequently carries obligations to society in this respect.

The investigation has therefore considered to what extent there are factors within the sector's control that can make a significant difference to higher education output and outcomes, and what patterns of performance need to be changed decisively in order to help realise South Africa's intellectual potential. The factor that the investigation has focused on is the structure of South Africa's undergraduate curricula, rather than issues of content and canon, as explained below.

³ The CDE study found a differential in unemployment rates between degree-holders and people with non-degree tertiary qualifications. Even so, 'the broad unemployment rate for anyone with post-matric qualifications of three or more years was 5 per cent in 2007' (CDE 2013:7). Since unemployment was at a low in 2007, direct comparison with the 2011 figure is not possible, but it is nevertheless clear that the position is favourable for holders of three-year diplomas as well as degrees.

2.2 The significance of curriculum structure

There are longstanding *prima facie* indications of systemic problems affecting higher education, particularly in the structure of first degree and diploma programmes. A major manifestation of this is the discontinuity between schooling and higher education which affects a very large proportion of the higher education intake, and which, as argued in this report, is one of the main factors behind failure and dropout. Whatever the root causes of this may be, it is evident that improvement of graduate output and outcomes will be severely impeded unless this fault-line, as well as related systemic problems, is purposefully addressed.

The role of dysfunctional schooling and socio-economic conditions must be fully acknowledged. However, the appropriateness of higher education's longstanding structures and approaches for contemporary conditions also needs to be considered. It is important to note that the origins of South Africa's current higher education curriculum structures lie in the adoption, early in the twentieth century, of the Scottish educational framework. This came about because of colonial ties and specifically because, like Scotland, the South African school system ended a year below the English A-level. It is for this reason that South Africa adopted a separate Honours qualification, designed to bring students up to the level of a (three-year) English Honours degree. As the environment and expectations of higher education in these countries have diverged since then, and as conditions in South Africa have changed so radically, it is timely now to review to what extent our embedded curriculum structures and assumptions are meeting contemporary needs.

In comparison with other aspects of higher education in South Africa, curriculum has received relatively little systematic policy attention over the last two decades. This applies to the structure of degree and diploma programmes as well as the substance of curricula. Despite recognition of the issue (as outlined in Chapter 1), major higher education policy documents have not approached structural curriculum issues in depth.

It is appreciated that many efforts have been made within institutions and by professional bodies to update courses and curricula and to take account of developments in the disciplines and professions. In addition, the substantial investment and effort made by the state and most higher education institutions in introducing foundational provision and extended programmes – a form of curriculum intervention – deserves full recognition. Moreover, a positive outcome of the institutional mergers is that there has been renewed motivation in some institutions to consider the possibilities of articulation between career-focused, professional and academic qualifications. This has begun to stimulate purposeful analysis of differences and commonalities across these categories of curricula, as well as of underlying epistemological issues.

However, rapid societal change and persistent inequalities suggest a need to consider curriculum more fundamentally, focusing in the first instance on the structural parameters of first degree and diploma programmes. The need arises both from local conditions affecting South Africa and from changing global conditions and associated developments in higher education internationally. This investigation has focused on two inter-related motivations for considering systemic reform:

- **‘Equity and development’:** meeting the country's need for graduates in terms of numbers, quality and mix, in the interests of social cohesion and all forms of development. Given

- national economic, social and political conditions, this is an essential condition for progress.
- **Enhancing graduate quality:** This crucial goal has a range of facets. As discussed earlier, raising the level of ‘educatedness’ in South African society is one of the keys to social as well as economic development, and to entrenching democracy and responsible citizenship. Hence, graduate attributes beyond technical and professional expertise are of major significance. In addition, it is now widely recognised – and expressed in the ‘Graduates for the 21st Century’ movement, for example – that the rapid and sometimes fundamental change occurring locally and globally makes it essential for higher education curricula to be enhanced to meet contemporary national, regional and world conditions.

The analysis in this report indicates that – irrespective of the root cause – there is effectively no room in South Africa’s current higher education curricula for these critical goals to be met. This arises from constraints that are inherent in the structure of the established undergraduate degree and diploma programmes, particularly in the fundamental parameters of starting point (and related assumptions about prior knowledge), duration, and the pace and flexibility of progression pathways.

The proposals in this report are thus intended to contribute to meeting the goals of equity, development and enhancement in the South African context by directly addressing these structural constraints, with the goal of establishing conditions in which the academic potential in the population can be better realised.

2.3 Is time a valid and useful parameter of curriculum structure?

In considering curriculum parameters, the issue of time and its significance in curriculum design needs to be examined and clarified. In South Africa (as in many other countries), the standard or ‘formal’ time allocated to higher education qualifications is commonly seen as a defining element, in the minds of students, employers and the public at large. The formal duration of programmes, expressed in years or sometimes semesters, is also used as the basis for much academic planning as well as for state funding and students’ tuition fees. In common parlance, a ‘general formative Bachelor’s degree’ is known simply as a ‘three-year degree’, distinguishable from professional first Bachelor’s degrees, which are ‘four-year degrees’.

This emphasis on duration in calendar years arose at a time of much greater homogeneity in student intakes and institutional conditions than is the case now. However, it has become increasingly problematic for a number of reasons, particularly the following:

- The great majority of both contact and distance students do not complete their degrees or diplomas in the formal or ‘regulation’ time. The main reasons for this are failure, which requires students to repeat courses, or inability to study full-time, because of personal circumstances such as lack of funding, family obligations or work commitments.
- The actual learning time in an academic year can vary substantially, between institutions (particularly between public and private institutions) and even between students in the same programme, because of the availability of summer- and winter-term courses (offered outside of regular term-time) for those who can afford them, and, perhaps increasingly, online courses that can be taken for credit.

Conditions like these undermine the validity of attaching a specific timeframe to study programmes.

More seriously, as this report argues, timeframes that do not match reality can be a major obstacle to student success because of the constraints they impose on curriculum design and funding. In these circumstances, classifying programmes by the number and level of credits required (as is in fact the case in the Higher Education Qualifications Sub-Framework – see Section 8.6) would be more logical.

Nevertheless, in practice, formal duration continues to be a key consideration, especially as it remains an integral factor in state funding and a basis for planning on the part of students and their sponsors. This report therefore uses formal time as a key measure, assuming full-time study and a standard academic year as followed in most public higher education institutions. However, the use of time as a valid parameter of curriculum design is subject to the following critical stipulations:

- Time as a curriculum parameter must mean productive learning hours for the student – ‘time-on-task’ as it is commonly known – rather than simply the duration of a programme. Extra time does not necessarily facilitate learning unless constructive use is made of this time. For example, experience with extended curriculum programmes indicates that simply spreading the standard courses of a programme over a longer period – say, over four years for a ‘three-year’ degree – is not an effective response to the learning needs of most students who struggle in current mainstream curricula: it reduces workload but does not address the fundamental problem of mismatch between assumptions about prior learning and students’ actual educational backgrounds.
- The term ‘curriculum space’ is thus a useful alternative to ‘time’ as a curriculum design parameter, signifying provision for time-on-task but carrying less ambiguity. To facilitate constructive learning rather than ‘cramming’, a curriculum must provide adequate room for teaching or mediation, in whatever form, and for private study and reflection, singly or in small groups. As mentioned earlier, the absence of sufficient curriculum space for key forms of learning in many current programmes – and at various transitional phases in the curriculum – is a major structural impediment to student success. The term ‘curriculum space’ is used in this sense in this report.
- If time-on-task rather than duration is the proper measure, it follows that, if provision is made for substantial additional teaching and learning in the calendar year, a well-prepared student could complete a programme in less than the formally allocated time. However, there are important caveats here. First, the negative effects of curriculum ‘jamming’ or overloading within standard programmes are widely recognised; this is not the same as using more weeks in the year for teaching and learning but similar overload effects would need to be guarded against. Second, a maturational effect of elapsed time has been observed in higher education, particularly in the fourth year and beyond; this has not been established through research but may prove to be an important consideration in curriculum design in South Africa, as noted in sections of this report.
- Digital educational technology and online learning will no doubt impact increasingly on teaching and learning in higher education. However, the need for sufficient time-on-task will remain, so changes in mode of delivery of undergraduate education will not affect the case for systemic change put forward in this report.

The overarching point is that curriculum parameters such as time and space must be in the service of learning, rather than a constraint on it. Good educational design, informed by the context, is essential for facilitating learning. Providing a structure that enables such design to be implemented is the central goal of this report's recommendations.

3. Graduate output in South Africa

Chapter overview

Against the backdrop of the importance of more graduates and appropriate graduate attributes to the country, this chapter offers an analysis of South Africa's actual graduate output in recent years, setting out key performance patterns across the higher education sector. It first analyses access in terms of participation rates, and then investigates two measures that indicate the effectiveness and efficiency of the higher education system, that is, graduation in regulation time and first-year attrition. The main focus of the chapter thereafter is the presentation of cohort completion rates overall and by population group. The chapter concludes that the implications of the performance patterns are multiple and far-reaching, but that in the main, the twin goals of equity and development are not being met. South African higher education can therefore be described as a 'low-participation, high-attrition' system (Fisher and Scott 2011:1).

3.1 Introduction

At the centre of the transformation agenda in higher education is the issue of equity and development – where equity refers to redressing the inequities of the past and development means the production of graduates with the skills and competencies required to address the advanced knowledge and human resource needs of South Africa (Wolpe *et al.* 1993). As noted above, the achievement of these policy goals is dependent on the expansion of the higher education system.

Indeed, in the period since the transition to democracy in 1994, there has been substantial growth in higher education enrolments. The higher education system has grown by over 80% since 1994, to a total enrolment of over 900,000. Significantly, this growth has contributed much to redressing race and gender inequalities in admissions, with African enrolments reaching 79% and female enrolments 57% of the total by 2010. The 'graduation rate', that is, the number of graduates as a percentage of head count enrolments in a given year, has also grown, though only marginally from 15% in 1994 to 17% in 2010. In terms of population groups, the number of African and coloured graduates, and their proportions in total graduate output, have increased substantially: for example, the number of African first-degree graduates grew by 50% between 1995 and 2010, to some 31,000 (CDE 2013: 12).

However, the growth has come from a low and racially skewed base, and the system continues to have major shortcomings in terms of the key goals of development, equity and enhancement set out in Chapter 2. This chapter analyses the current state of graduate output. The data presented are quantitative, and the analysis focuses on the effectiveness of the higher education system in terms of overall graduate production and the extent to which representivity is being achieved in the graduating class. It therefore addresses key aspects of the goals of development and equity. The goal of enhancement of graduate quality is discussed in Chapter 6.

Among the points arising from the performance patterns are two that have particular salience for higher education policy. First, growth in enrolment has been accompanied by high failure and dropout rates, which undermines graduate output. Second, the gains made in equity of access have not been complemented by equity of outcomes; the system has not yet come to terms with the learning needs of the majority of the student body. This chapter explores the relevant data in order to clearly delineate the challenges and to inform the development of interventions that can bring about substantial positive change.

A note on the data

The data analysis in this report is cohort-based, that is, it is based on longitudinal tracking and analysis of the performance of all students who are first-time entrants in a given year through to completion or termination of their undergraduate studies. This provides a better and more reliable picture of the proportion of students completing their studies than the 'graduation rate' used by the DHET, which calculates the number of graduates in a given year expressed as a percentage of that year's total enrolment. The graduation rate is skewed by fluctuations in enrolment and is at best a proxy for the proportion of students completing their studies. In the recent past, that is, until the introduction of the Higher Education Management Information System (HEMIS) a decade ago, it was not possible at the national level to track the performance of individual students, and hence the graduation rate was used as a proxy for student performance by the then Department of Education.

To avoid confusion, this report uses the term '(cohort) completion rate' to refer to the percentage of a given student intake, or cohort, that graduates.

The data analysis is based on the 2005 and 2006 first-time entering cohorts, tracking their performance over a 5-6 year period. These cohorts are the latest for which sufficient longitudinal data are available. The data cover the period following the restructuring of the institutional landscape of the higher education system through mergers and incorporation.⁴ The analysis in the body of the report is based on the 2006 first-time entering cohort. The reason for focusing on one cohort is that the performance patterns have proved to be robust in that, with some exceptions noted in the text, differences at the level of the qualification type (i.e. general formative Bachelor's degrees, diplomas and professional Bachelor's degrees) between the two cohorts studied are minor. As is to be expected, there are wider differences at the individual programme level, but most of these do not point to any discernible trends that impact on the overall analysis. In addition, for comparative purposes, the 2006 cohort analysis has also been cross-referenced with the 2000 and 2001 first-time entering cohort study published in the CHE's *Higher Education Monitor 6* (Scott, Yeld and Hendry 2007).

3.2 Access and participation rates

As indicated earlier, access to higher education has widened significantly since 1994. However, although substantial, the growth is not sufficient to meet the human resource needs of South

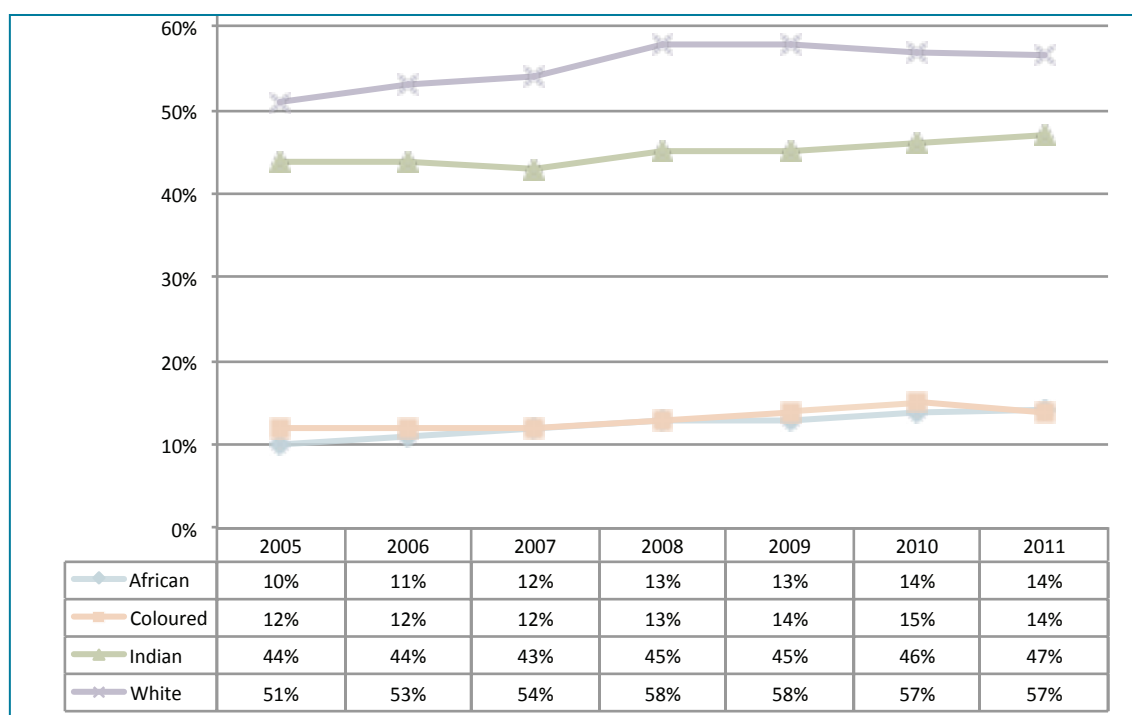
4 Examples of the detailed cohort data can be found at www.che.ac.za.

Africa, as shown by the continued shortages of high-level skills. The National Plan for Higher Education, based on an analysis of enrolment patterns in comparable middle-income countries, set a participation rate target of 20% over a 10-15 year period, following a recommendation from the CHE's size and shape report (DoE 2001: 21-22).

The higher education participation rate used here is the Gross Enrolment Ratio (GER), defined by UNESCO as the total enrolment (of all ages) expressed as a percentage of the 20-24 year-old age group in the population (UNESCO 2010). It provides a measure of access to higher education and is critical for understanding and assessing the performance of the higher education system, as the international evidence suggests that there is a correlation between higher education participation levels and economic development (World Bank 2000). The participation rate in higher education in South Africa has increased from 15% in 2000 to 18% in 2010. The steady growth since 2005 suggests that the 20% target is likely to be met by 2015/16. However, although significantly higher than the average GER for sub-Saharan Africa, which is 6%, it is well below the average for Latin America (34%) and Central Asia (31%) (UNESCO 2010). In line with such trends, the Green Paper (DHET 2012a) has revised the participation rate target to 23% by 2030, which is still modest. Despite the growth, it is clear that the low participation rate continues to act as a brake on social and economic development and is a key factor in explaining the shortage of high-level skills. This is compounded by poor completion rates, as discussed below.

Significantly, underlying the overall GER are continuing racial inequalities. Participation rates for white and Indian students are comparable with developed country figures but the participation rate for African and coloured students is persistently very low: under a quarter of that of whites, as shown in Figure 1.

Figure 1: Gross higher education participation rates by race for 2005 to 2011



Three key implications arise from this brief analysis of participation rates in higher education in South Africa:

- Although there has been significant progress in improving African and coloured participation in absolute terms, redress of racial inequalities is a continuing challenge in relative terms. Thus, any planned growth in enrolments would have to focus primarily on African and coloured students.
- The low African and coloured participation rates indicate that the intake of African and coloured students represents a highly selected group – effectively the top 10% of African and coloured youth – that collectively must have high potential to succeed. Realising this potential is essential for social and economic development and social cohesion. It should therefore be a central goal for the higher education system, and a key benchmark measure of its success.
- The low participation rates have implications for social and economic development, especially given poor completion rates. This raises the central question of what kind of growth is needed in higher education. Clearly, what is needed for development is growth in graduates rather than in access *per se*. It follows that academic planning should focus on graduate output, and that all reasonable provision must be made for the students admitted to higher education to complete their studies successfully. Since it is the output that counts, knowing what happens to the student intake is critical. Cohort analyses give the clearest picture of this, and can also indicate how best to grow graduate output.

3.3 Graduation in regulation time

A key measure of the effectiveness and internal efficiency of a higher education system is graduation in regulation time, which means the number of years a full-time student is expected to take to complete a qualification. The expected duration of a qualification is indicated by the formal time allocated to it in the funding framework: a diploma and a general formative Bachelor's degree should take three years to complete and a professional Bachelor's degree four years.

Higher education institutions design curricula with the purpose of enabling students to complete their studies within the approved formal time. However, irrespective of how careful the design, if students are not able to follow the curriculum as planned, its fitness for purpose is undermined, with the result that the student's actual curriculum path loses coherence and is subject to step changes in pace, volume and difficulty that commonly lead to poor performance or failure. Where this affects a substantial proportion of the student body, and particularly where the intake is small and select as is the case in South Africa, it is a strong indicator of systemic faults in the educational process.

The significance of this measure therefore lies both in its direct relevance to graduate output and in what it indicates about the underlying factors affecting performance. Table 1 provides data on the proportion of the 2006 cohort that graduated in regulation time, and also the proportion that had failed or dropped out by the end of the regulation time, for each qualification type. UNISA is excluded because it is to be expected that distance education students, the majority of whom are part-time students, will take a longer time to complete their studies.

In this table and a number of others in the chapter, data are provided by population group as well as for all students. This is because of the ongoing need for redress of historical inequality that is evident in the system, and also because of the implications it has for improving graduate output, since it is clear from the participation rates that growth in graduate numbers must come predominantly from the under-represented groups, that is, African and coloured students.

Table 1: Graduation in regulation time, overall and by population group (%): 2006 first-time entering cohort, excluding UNISA

	Graduation in Regulation Time (%)					Attrition by end of Regulation Time (%)				
	African	Coloured	Indian	White	All	African	Coloured	Indian	White	All
3-year degrees	20	20	26	43	29	39	50	37	31	37
4-year degrees	30	28	31	47	36	41	47	43	33	39
3-year diplomas ⁵	16	27	27	38	20	45	45	39	38	44
All 3- and 4-year qualifications	20	24	28	44	27	42	47	39	33	40

Analysis of the data indicates the following:

- The proportion of the intake into contact institutions that is well-enough prepared to complete undergraduate curricula within the intended time is small – only 27%, or roughly only one in every four. It also shows the high rate of attrition that has occurred by the end of regulation time: 40% overall.
- Performance is very poor for all groups across the three qualification types. Even in the four-year professional degrees, which are highly selective in terms of admissions requirements, the rate is only 36%.
- Within the generally poor performance patterns, there nevertheless continue to be substantial racial disparities. Very small proportions of African, coloured and Indian students graduate in regulation time.
- By the end of the regulation time in all three qualification types, more students have been lost to failure and dropout than have graduated – more than twice as many in the case of African and diploma students.
- In all groups, the completion rates are consistently better in the professional Bachelor's degrees in general than in the other qualification types, and overall, performance is poorest in the diplomas. The patterns of attrition are not consistent in the same way.
- In additional data available on www.che.ac.za, it is evident that the completion rates are especially low in Engineering and Science degrees and diplomas as well as the professional Commerce degrees, all of which have particular significance for economic development. The rates for these qualifications are: BEng 23%; BSc 23%; Engineering diplomas 5%; Science diplomas 14%; four-year Commerce degrees 26%.

⁵ The diplomas referred to in this chapter are the 3-year diplomas offered by universities of technology and comprehensive universities.

Wider implications of the performance patterns are discussed in Section 3.6 below.

3.4 First-year attrition

First-year attrition is a second indicator of the higher education sector's capacity to meet the needs of entering students. Like graduation in regulation time, it is both significant in itself and as a diagnostic measure of system effectiveness. Table 2 provides an overview.

Table 2: First-year attrition, overall and by population group (%): 2006 first-time entering cohort

	African	Coloured	Indian	White	All
Contact 3-year degrees	24	34	26	22	24
Contact 4-year degrees	22	23	27	19	21
Contact 3-year diplomas	24	29	23	23	25
All 3- and 4-year qualifications (including UNISA)	34	39	34	29	33

The table indicates that first-year attrition is very high. In addition, analysis of available data, including a comparison with a prior study (Scott *et al.* 2007) indicates the following:

- First-year attrition is a longstanding problem in South Africa, going back many decades (see Section 4.3). In particular, there has been very little change since 2000 (Scott *et al.* 2007: 28). The rate for the contact diplomas is virtually the same as then, and there has been some worsening in 3- and 4-year contact degrees (from 19% to 23%) and for all 3- and 4-year qualifications (from 29% to 33%). In these programmes, the actual first-year loss to the system in 2006 was nearly 42,000 students out of the first-time entering total of about 127,000 – that is, one in every three students who entered.
- The 2006 first-year attrition rates show continuation of racial disparities: African 34%; coloured 39%; Indian 34%; white 29%. These figures deviate somewhat from the common pattern in that African attrition was lower than coloured and on a par with the Indian rates. This may be linked to the growth of extended curriculum programmes, which generally improve first-year retention.

First-year attrition is a common problem internationally but is usually associated with high levels of access. However, given South Africa's low participation rate, it has particularly damaging effects.

The data on first-year attrition and graduation in regulation time support the contention that much of the poor performance in higher education can be attributed to the articulation gap between school and higher education. The data also challenge the widely-held view that systemic faults arise exclusively from the poor quality of black schooling in general and African schooling in particular. It is clear that systemic problems affect the whole school system, the functional and well-resourced schools as well as the dysfunctional and poorly-resourced ones. The data thus raise questions about the quality of schooling in South Africa in general and support the thesis

that the articulation gap affects the majority of students. This has key implications for the design of higher education curricula, as discussed below.

3.4 Cohort completion rates of all first-time entering students

An overview of performance in the form of five-year completion rates (that is, graduation in regulation time plus two years for three-year qualifications, and plus one year for professional four-year degrees) for all first-time entering students is provided in Table 3. In this and subsequent tables, figures for the contact institutions and UNISA are given separately because of the different performance patterns that can be expected from UNISA as an open and distance learning institution. The aggregated figures for all institutions are also given, to indicate the performance of the higher education system as a whole.

A proportion of the intake remain in the system, or return to it, after the five-year period. The numbers of students in this category, and their probability of graduating, have been estimated on the basis of available data. Using these estimates, the 'final attrition' rates for the cohort – that is, the percentage of the intake that will never graduate – have been calculated and are shown in the last column of the table.

Table 3: Cohort completion rates of all first-time entering students: 2006 cohort

		Graduated within 5 years (%)	Estimated % that will never graduate
Contact institutions	3-year degrees	53	41
	4-year degrees	49	41
	All 3- & 4-year degrees	52	41
	3-year diplomas	42	50
	All 3- & 4-year qualifications	48	45
UNISA	3-year degrees	9	72
	4-year degrees	8	72
	All 3- & 4-year degrees	8	72
	3-year diplomas	2	89
	All 3- & 4-year qualifications	6	78
All institutions	3-year degrees	38	52
	4-year degrees	37	50
	All 3- & 4-year degrees	38	51
	3-year diplomas	30	62
	All 3- & 4-year qualifications	35	55

The cohort analysis shows a pattern of very high overall undergraduate attrition. Five years after entering, only 35% of the 2006 cohort had graduated, including under half of the contact students. The estimated final attrition rates are 55% for the full intake and 45% for all contact students. The loss of about half of the country's small intake is unacceptable.

Poor performance is widespread. The traditional contact university degree programmes – primarily the three-year Bachelor's and the highly selective four-year professional Bachelor's programmes – make up the best-performing sub-sector, but even there the cohort completion rate after five years is only 52%. In the three-year diplomas – a qualification type where substantial growth is needed for technological development – the completion rate in contact institutions is 42%, remaining well below the rate for degrees.

Since distance education students can be expected to take more time than contact students to complete their studies, the five-year period of the cohort study is not long enough to provide a full picture of these students' performance. Nevertheless, performance at UNISA (especially in diplomas) is a major concern. Detailed UNISA data show that the rates of attrition within *four* years were 67% for 3-year degrees, 67% for 4-year degrees, and 86% for 3-year diplomas. These indicate the low proportion of the UNISA intake that will ever graduate. Since UNISA's headcount enrolment represents about a third of South Africa's total higher education participation, these performance patterns have significant implications for overall graduate output. While it is recognised that distance education completion rates are affected by some important factors that do not apply equally to contact institutions, the recommendations arising from this investigation need to be considered by UNISA as well.

In an environment of scarce skills, the level of under-development of the country's talent shown in these figures is highly damaging and costly. The poor performance in Science, Engineering and Technology (SET) and professional programmes is of particular concern, given the short supply of high-level skills in these fields. Poor performance, however, occurs in a wide range of programmes. Table 4 shows performance in specific programmes or clusters of cognate programmes, selected on the basis of large enrolments and significance.

Table 4: Graduation within 5 years in selected qualifications (%): 2006 first-time entering cohort

		Contact institutions	UNISA
3-year degrees	BCom	58	9
	BSc	48	4
	BA	53	12
	BSocSc	54	7
	All 3-year degrees	53	9
4-year degrees	Com/Bus/Management ²	35	10
	Engineering	41	n/a
	Law	41	2
	Health	68	n/a
	Education	58	13
	Social Science	61	8
	All 4-year degrees	49	8
3-year diplomas	Com/Bus/Management ⁶	43	1
	Engineering	29	1
	Science	37	1
	Public Management	49	4
	All 3-year diplomas	42	2

Key points in relation to the contact institutions include the following:

- With the exception of the professional four-year degrees in the Health and Social Sciences, no programme has a five-year completion rate of over 60%, not even the other professional degrees, which are generally highly selective.
- Most of the degree completion rates are in the low 50% area or below. All the diploma rates are less than 50%.
- Again, performance in SET programmes in all three qualification types is well below the average and markedly below that in the Humanities and Education areas.⁷ This has major implications for economic and technological development, particularly the prospects of addressing skills shortages in these areas.
- The relatively low completion rates in some of the four-year degrees results from the

⁶ This category includes professionally-orientated 4-year programmes (such as the Bachelor of Business Science) in Business-related subjects.

⁷ The professional four-year Law degrees, which require *inter alia* precision in language, have also had low completion rates for many years.

cohort period in the table being only one year longer than the regulation time. Even so, the performance in such highly selective programmes is a cause for concern.

- There are also interesting comparisons to be made across the various cohorts that have been studied, though these need to be treated with caution for two main reasons. First, the 2000 and 2001 cohort studies are not fully comparable with the later ones because data at the level of individual programmes were not available at that time, so subject categories (CESMs) were used instead. Second, the changes in the institutional landscape since 2001 may have affected performance and reporting of performance in ways that have not been taken into account. There are also not yet sufficient longitudinal data available to enable rigorous trend analysis.

With these caveats, the following observations can be made regarding performance in the contact institutions:⁸

- In the degree programmes, there is little appreciable change to the overall patterns that emerged in the 2000 cohort,⁹ with performance continuing to be poor across the board. It appears that little progress has been made in coming to terms with the learning needs of the intake as a whole.
- In the individual degree programmes (or programme clusters), comparison between the 2000 and 2006 cohorts shows some positive and some negative changes. The most significant improvements have occurred in non-SET programmes – particularly in the general BCom and the 4-year LLB, the latter from a very low base. In SET programmes, by contrast, there has been no improvement in the BSc and disturbing deterioration in Engineering and the professional Bachelor's degrees in Commerce, Business and Management.
- The 2006 cohort figures are better than those for the 2005 intake in a number of programmes. However, the 2005 cohort's performance was appreciably below that of the 2000 cohort. The 2006 cohort improvement brought performance back up to the levels of the 2000 cohort, with the exceptions of the Engineering and professional Commerce, Business and Management programmes, which have steadily declined. The overall completion rate in the professional degree category is in fact bolstered mainly by relatively good performance in the Health Sciences, Education and Social Sciences.
- In the diplomas, performance has improved significantly since the 2000 intake in all the major programme clusters. However, it remains very poor overall, again particularly in the areas of Engineering and Science. It is in this key qualification type that the loss of talent continues to be the greatest.
- It is not clear what the improvement in performance in the diplomas and certain degree programmes may be attributable to, particularly the short-term changes between the 2005 and 2006 cohorts. There is no evidence of substantial improvement in the preparedness of the intake having occurred between 2005 and 2006, nor of a general improvement in higher education teaching (and it is difficult to envisage what might bring about a substantial increase in the overall effectiveness of teaching from one intake to the next). In some cases, the institutional mergers coming into effect at that time may have focused attention on educational management, but it is not clear what short-term improvements they may have brought about in teaching and learning.

⁸ The detail on which these observations are based is provided in the cohort studies available at www.che.ac.za.

⁹ The patterns in the 2000 and 2001 cohorts were so similar that only the 2000 cohort is referred to here.

In these circumstances, the factor that is most likely to have contributed to improved performance is the expansion of extended curriculum programmes, which provide at-risk students with substantial foundational provision that is integrated into and extends the duration of a regular degree or diploma programme. The first cycle of large-scale state funding for extended programmes was 2004-2006, and a number of programmes began to take root only towards the end of that period. Quantitative data on performance in extended programmes was collected by the Department of Education only from 2007, so no direct sector-wide evidence of their effect on the 2005 and 2006 cohorts is available. However, the data collected since then indicates a positive impact, as outlined in Chapter 5. The extended programme intervention thus appears to be the only substantial factor affecting the teaching and learning process at the time. The performance of extended programmes is an important element in considering ways of improving higher education outcomes.

Whatever the causes of the performance fluctuations may be, the overall import of the patterns has remained consistent, pointing to systemic problems that call for urgent attention.

3.5 Equity: Cohort completion rates by population group

Table 5: Graduation within 5 years, by population group (%): 2006 first-time entering cohort

		African	Coloured	Indian	White	Ratio of white to African completion rates ¹⁰
Contact institutions	3-year degrees	47	42	56	64	1.4
	4-year degrees	44	41	46	58	1.3
	3- & 4-year degrees	46	41	52	62	1.3
	3-year diplomas	39	46	49	55	1.4
	All 3- & 4-year qualifications	42	43	51	61	1.5
All Institutions (including UNISA)	3-year degrees	32	29	32	51	1.6
	4-year degrees	32	33	29	48	1.5
	3- & 4-year degrees	32	31	31	50	1.6
	3-year diplomas	29	31	32	34	1.2
	All 3- & 4-year qualifications	30	31	31	47	1.6

¹⁰ This ratio represents the white completion rate divided by the African completion rate. Thus, the first row shows that the white completion rate was 1.4 times (or 40%) higher than the African rate.

Progress towards equity in output – that is, representivity of the population in the graduating class – remains critical in South Africa. The equity aspect of this study, discussed below, has focused on analysis by population group rather than gender because the largest disparities in performance are associated with the pervasive effects of historical racial discrimination. A detailed study of performance by gender would be valuable in identifying other areas of access and success that call for attention.

Table 5 disaggregates the performance of the 2006 cohort by population group in the three qualification types studied.

Further disaggregating this overview to the level of individual programmes or programme clusters reveals some significant patterns, as indicated in Table 6.

Table 6: Graduation within 5 years in selected qualifications, by population group (%): 2006 first-time entering cohort, excluding UNISA

		African	Coloured	Indian	White	Ratio of white to African completion rates ¹¹
3-year degrees	BCom	49	44	65	68	1.4
	BSc	41	39	48	60	1.5
	BA	49	38	49	63	1.3
	BSocSc	52	54	51	59	1.1
4-year degrees	Com/Bus/Management	17	47	36	51	3.0
	Engineering	23	41	37	55	2.4
	Law	41	24	42	48	1.2
	Health	61	63	65	81	1.3
	Education	54	42	70	65	1.2
3-year diplomas	Com/Bus/Management	42	43	52	53	1.3
	Engineering	27	44	32	41	1.5
	Science	37	43	41	40	1.1
	Public Management	49	44	44	50	1.0

¹¹ See footnote on previous table.

A brief analysis of the data in Tables 5 and 6 above, together with other cohort data available at www.che.ac.za, indicates the following:

- No group is performing well. More than a third of the best performing group, white students in contact institutions (mainly historically advantaged universities), fail to graduate within five years.
- However, African and coloured student performance remains the biggest cause for concern. Only 42% of African contact students graduate within five years, and if UNISA (which provides educational opportunities for large numbers of African students) is included, the number drops to 30%. The performance of coloured students in contact institutions is only one percentage point better overall in each case.

Given the participation rates shown in Figure 1, the net effect of the performance patterns is that only 5% of African and coloured youth are succeeding in higher education. This represents an unacceptable failure to develop the talent in the groups where realisation of potential is most important.

- African and coloured five-year completion rates are under 50% in most programmes, and, with the exceptions of Health Sciences and Education, unacceptably low in the professional degree programmes. Completion rates are generally lowest in the SET programmes – BSc, Engineering degrees, and Science and Engineering diplomas – and the professional Commerce and Law degrees.
- Indian students' performance is generally better than that of African and coloured students in the contact institutions, but this pattern is not maintained at UNISA and in some specific programmes.
- The gap between African and white five-year completion rates remains substantial, commonly in the region of 15 percentage points in the case of the 2006 cohort. The overall ratio of about 1.5 between the white and African rates (i.e. the white rate is 50% higher than the African rate on average) is a further indicator of the differential. The largest disparities are in Engineering, Science and the professional Commerce degree. The gap between white and coloured students in three-year degree programmes is notably high.

Comparisons across the cohorts also indicate some patterns, subject to the caveats outlined under Table 4.

- In the contact institutions, African five-year completion rates increased significantly from the 2000 to the 2006 cohort in all three qualification types (by 10 percentage points or more in some programmes), particularly in three-year degrees and diplomas. This positive pattern is marred by a marked deterioration in the professional Commerce and Engineering degrees, by 16 and 9 percentage points respectively. The increases have come from a low base and it is clearly critical to create conditions for consolidating and improving the gains.
- Another positive pattern is that, in contact degree programmes, the average gap between the African and white five-year completion rates narrowed appreciably from the 2000 to the 2006 cohort. In a number of programmes, the narrowing arose from deterioration in the white completion rate (the reasons for which are not known) as well as improvement in the African completion rate. In contrast, the gap widened in the case of the professional

Commerce and Engineering degrees. This has implications for growth in the sector and for national development.

- In the diplomas, the gap between the African and white rates remained the lowest of the three qualification types.
- It is not known what the narrowing of the gap can be attributed to. It is possible that the expansion of extended curriculum programmes made a significant contribution (see Chapter 5 below).

3.6 Summary of the implications of the performance patterns

- The current higher education system is not producing sufficient graduates to meet national needs in respect of economic and social development, largely because much of the country's intellectual talent is not being developed. In the best-performing cohort analysed to date (the 2006 cohort), **only 35% graduated within five years, and it is estimated that 55% of the intake will never graduate.** This translates into a loss of some 70,000 students from the cohort. Failure to realise the potential of over half of the small proportion of the population that enter higher education makes it most unlikely that the shortages of high-level skills will be reversed.

The system is also not meeting the country's needs in respect of equity and social cohesion. The persistence of substantial inequalities in both participation and success means that the benefits of higher education continue to be inequitably distributed. Perhaps the most disturbing finding of the performance analysis is confirmation that the sector is catering successfully for only 5% of the African and coloured age-groups.

The performance figures show that these two problems are integrally linked, since it will not be possible to produce the number of graduates needed to drive development without realising the intellectual potential in previously disadvantaged communities. The goals of equity and development – seen for a long time as being in competition – have thus converged, since enabling a substantially higher proportion of African and coloured students to succeed is the key to improving the performance of the sector as a whole, and is hence a necessary condition for economic development as well as social inclusion.

- High levels of attrition occur in many systems but are most commonly associated with high levels of participation. South African higher education, in contrast, is a low-participation, high-attrition system (Fisher and Scott 2011: 1,9).
- It is clear that the central shortcoming of the system is that, in the second decade after the political transition, it is not yet meeting the needs of the majority population groups, which also means the majority of the student intake. African and coloured students remain seriously under-represented in participation and in the graduating class. This has major implications for increasing access, since the groups from which growth must predominantly come are also those that are least well served by the system.

In current circumstances, expanding the intake will result in increasing the proportion of underprepared students in the system. Unless the effectiveness of the educational process within higher education is improved, the performance patterns will deteriorate, leading to lower completion rates and a substantial increase in the absolute number of students

who fail or drop out. Increasing access would then have the unintended consequence of exacerbating the negative performance patterns and the untenable wastage of human and material resources that results. The pressing need, therefore, is not simply to widen access but rather to widen *successful* participation.

- Persistent failure and attrition on the scale shown in the performance patterns, within a small and select intake, cannot be attributed simply to student deficits or poor teaching, and will not change spontaneously. Moreover, it cannot in any simple way be ascribed primarily to affective or material factors; similar or worse conditions are present in other sub-Saharan African countries without such poor outcomes.¹² Rather, the indications are that the under-performance must be systemic in origin.

Systemic faults will not yield to peripheral or supplementary interventions but call for purposeful and effective systemic responses. The evidence for this comes from a range of sources: for example, quantitative indicators of the kind outlined above; qualitative and theoretical analysis; assessment of student performance at different levels of the education system, particularly at the interface between secondary and higher education; and extensive experience of educational development interventions across the higher education sector, spanning three decades. The evidence for this argument is discussed in Chapters 4 and 5 below, as are two key questions:

- What are the obstacles to success in higher education for the majority of the student body?
- What will it take, in practice, to bring about the substantial improvement that the country needs?

¹² While higher education systems in almost all other sub-Saharan African countries are much smaller and have lower participation rates than South Africa, their estimated completion rates are at least comparable, and the proportion of their youth that succeed in higher education is not dissimilar in absolute terms. The latter figure for sub-Saharan Africa is estimated (albeit without comprehensive data) at over 3%, whereas in South Africa 5% of the majority population group are succeeding (derived from UNESCO 2010 and Africa Higher Education 2008).

4. Improving graduate output: What stands in the way?

Chapter Overview

The mismatch that has been outlined between the current outcomes of higher education and the country's need for well-qualified graduates, in the interests of development and equity, has been identified as systemic in origin, and calls for concerted and accurately directed action at system level. This chapter outlines factors affecting performance in higher education, and identifies key obstacles to improvement as a basis for planning developmental action. After examining material, affective and academic factors, it posits that a key factor is the articulation gap between school and higher education.

Having discussed the history and significance of the articulation gap, it analyses the potential of other sectors of the education system – the schools and further education and training (FET) – to deliver interventions that will make a substantial difference. It concludes that systemic reform in higher education offers the most potential to narrow the articulation gap effectively.

4.1 Introduction

There is a growing body of research, in particular in the form of local and international retention studies, which indicates that success and failure in higher education is the result of a complex interplay of factors. These factors are both internal, that is, intrinsic to the higher education system, and external, in relation to social, cultural and material circumstances. It is beyond dispute that individuals who are socially and economically disadvantaged are less likely to gain access to and successfully complete any form of higher education. This is compounded in developing countries where poverty is widespread and opportunities to enter higher education are scarce.

The impact of socio-economic factors is evident in South Africa where inequalities are stark and take on a racial form linked to the apartheid past. These inequalities are persistent in education, as indicated by the continuing low participation and completion rates of African and coloured students in comparison with their white and Indian counterparts.

The major challenge for South Africa is that the obstacles to entering and succeeding in higher education affect the great majority of the population. In the long term, then, increasing the access and completion rates of African and coloured students depends much on addressing the social and economic factors – the persistent and far-reaching effects of poverty and associated inequalities – that influence performance in higher education.

It is clear, however, that whatever the merits or otherwise of policy interventions that have been put in place thus far, there has been limited success post-1994 in addressing these challenges. In particular, the quality of schooling continues to be undermined by the legacy and persistence of educational inequalities and dysfunction. This suggests that at least in the short-to-medium term, addressing the low participation and completion rates within higher education must include

identifying factors that are intrinsic to higher education, that is, the 'structures, conditions and practices' impacting on student performance that can be addressed by the higher education sector itself (Scott *et al.* 2007: 38). This would involve addressing a range of factors linked to poor student outcomes, as is succinctly captured by Lange:

The problem of poor student outcomes is a complex and multilayered one which is shaped by issues such as the lack of preparedness of students and staff; the nature and organisation of teaching and learning at higher education institutions; the conceptualisation of the education process, particularly in terms of the appropriateness of content and assessment methods and its relationship with different institutional cultures; the extent or lack of professionalisation of academic staff; the nature and extent of funding; and the role that system differentiation might have in addressing under-preparedness (Scott et al. 2007: 2).

In short, these factors can be construed as barriers to learning. Understanding them and their inter-relationship provides a basis for identifying the interventions that can be put in place to mitigate their adverse effects.

Because there are strongly differing views on where responsibility for lack of success at university lies, it is necessary to analyse what the various sectors of the education system can realistically be expected to contribute to improving performance in higher education. First, however, to determine what kind of contribution is needed, a review of the nature of the obstacles to learning as they manifest themselves in higher education itself is necessary.

4.2 Factors affecting performance in higher education

Categorising the factors that impact on student performance provides a useful point of departure for analytical purposes. The factors can be grouped under three broad headings, namely material factors, affective factors and academic factors. These factors are considered separately below. However, it is important to note that they are inter-related, and that the nature of the relationship, including issues of causality and mutual reinforcement, is complex.

Material factors

As indicated above, access to and success in higher education is strongly influenced by the socio-economic background of individuals. This is especially so in the South African context where the large majority of black students come from low-income families that do not have the financial resources to support the pursuit of higher education. Although the matter is under-researched and the Higher Education Management Information System (HEMIS) does not contain a field to capture the trend, there is anecdotal evidence to suggest that many students either do not enter higher education, or drop out without completing their studies, because of a lack of access to finance.

This is illustrated by the fact that demand for funding from the National Student Financial Aid Scheme (NSFAS) continually outstrips supply, even though since its establishment in 1994 the state allocation to the fund has increased exponentially, with nearly R5 billion disbursed to higher

education students in 2012 (NSFAS 2012:14). Despite this massive investment, however, there are widespread concerns about the adequacy of the funding and the disbursement policy. In response to demand, the institutional approach has been to provide partial support for larger numbers of students rather than full support for fewer students. While definitive longitudinal studies of NSFAS-supported students' completion rates are lacking, the funding gap experienced by indigent students is likely to have a negative effect on their performance and hence on the overall return on NSFAS investment. This suggests that if NSFAS is to be strengthened and contribute to improving graduate output, the focus should not only be on increasing the total funding available but also on the effectiveness and adequacy of the funding for facilitating learning (Letseka, Breier and Visser 2010).

It seems clear, therefore, that adequate finance remains a key barrier to access and success in higher education. However, addressing this is not sufficient in itself and would not preclude the need for substantive interventions in other areas. This is because a high proportion of the students affected by a lack of access to finance are also disadvantaged academically, in that the great majority come from under-resourced and/or poor quality schools.

Moreover, as the performance patterns indicate, many students who fail to complete their studies are not indigent. For example, even though only a small proportion of the white student population are eligible for need-based financial aid, about 40% of the total white intake do not graduate within five years. There are also relatively high attrition rates arising from academic exclusion in institutions that, despite charging the highest fees, have a high proportion of self-funded students. The scale of attrition among students with good school attainment and with no major material constraints points to systemic academic obstacles to learning.

This brief analysis of finance as a barrier to entering and succeeding in higher education suggests that while it continues to require focused intervention, addressing material disadvantage is not a substitute for dealing effectively with the academic and other factors impacting on student progression. Directing all available additional resources into student financial aid, as is sometimes suggested, would thus not be productive. If anything, it seems clear that the investment in NSFAS and private-sector bursary schemes needs to be complemented by interventions to improve the effectiveness of the educational process in higher education if a substantial increase in the number of graduates is to be achieved (Scott *et al.* 2007: 39). Equally important is addressing the affective or psychological and social factors that are also a barrier to success in higher education.

Affective factors

The role of affective factors in influencing student performance is widely recognised and confirmed by research studies. Its impact in South Africa is explained by Scott *et al.* (2007):

In South Africa, Academic Development experience has indicated that the benefits of well-designed educational interventions can be neutralised by lack of motivation, anxiety about personal or financial circumstances, or alienation from the institution... The relationship between affective factors and academic performance is likely to be iterative, however, so the other side of the coin is that students' confidence, motivation, and general wellness may be compromised by inability to cope with the educational process they find themselves in (Ibid.: 38-39).

The critical role of students' positive engagement with their studies and their institutions in facilitating success is confirmed by the emerging body of research on student engagement in South Africa, which focuses on analysing and understanding student attitudes, perceptions and motivation (SASSE 2012). This suggests that effective educational practices extend beyond the formal curriculum into the provision of psychological and social support, and of opportunities for students to engage actively with their institution and environment in a variety of ways. However, if the teaching and learning process is itself not effective or geared to facilitating positive learning, it cannot be compensated for by interventions that focus on addressing affective or material factors.

Academic factors

Whatever the significance of material and affective conditions, the key factors in student success are academic: in essence, formal learning depends on whether students can and do respond positively to the educational process in higher education. The educational process refers not only to 'teaching approaches but all aspects of the formal system, including the curriculum framework, the design of its component parts, assessment, and student support' (Scott *et al.* 2007: 39). Obstacles to successful interaction between students and the educational process clearly need to be identified and addressed in order to facilitate the substantial improvement in student learning that South Africa requires. Mitigating the learning-related obstacles of this kind is an essential if not sufficient condition for such improvement.

It is common cause that within the academic community and beyond, the dominant view of the reason for underperformance in higher education is that a high proportion of the entering students are underprepared for study at university level. The major cause of this underpreparedness is identified as poor schooling, exacerbated by unfavourable family and socio-economic conditions, which are all factors external to higher education. There can be little dispute about the influence of these factors. However, the issue of underpreparedness has been problematised by various parties over the last three decades, in terms of what it is understood to mean, what it consists in, and to what extent and in what ways it might be overcome (see for example Vilakazi 1985; Dhunpath and Vithal 2013). This is explored below.

4.3 The issue of underpreparedness

Studies over the last three decades indicate that student underpreparedness is a complex phenomenon, in at least two key respects. First, it is multi-faceted, involving not only subject knowledge but cognitive, epistemological, affective and socio-cultural dimensions. Second, attributing causality is not simple, given the range of dimensions that affect student performance and that are compounded by the (inherited) racially determined social and economic inequalities that continue to characterise South Africa.

Underpreparedness manifests itself in a range of ways, from struggling in the formal curriculum to difficulty with adjusting to independent study and a university environment. It takes different forms in different subject areas but the common feature in all settings is that what the students know and can do – attainments that were good enough to gain them entry to higher education – do not match the expectations of the institution. The following extract from the CHE's *Higher Education Monitor 6* (Scott *et al.* 2007: 36) provides an example of the mismatch, taken from the Humanities:

Those aspects of literacy required by contexts of learning and teaching that are highly dependent on reading and writing as vehicles for meaning construction, and whose context is customarily that of formal education, have become known as Academic Literacy. A concise outline of these aspects of literacy is offered below. In a higher education context, students are required to:

- *make meaning from what they read;*
- *understand and interpret conceptual and metaphorical language;*
- *identify and track academic argument;*
- *follow discourse structure in text;*
- *make inferences about and extrapolate from what they read;*
- *demonstrate familiarity with and understanding of the conventions of visual and multimodal literacies, such as reading and interpreting graphs, pictures, flow-charts and diagrams; and*
- *cope with basic numeracy (Cliff, Hanslo and Visser 2003).*

Meeting these requirements is a challenge for all students, and the difficulties faced in adjusting to independent study at this level are well known. For students from poor educational backgrounds, however, getting to grips with these requirements is seriously impeded by approaches to texts and epistemic practices such as those put forward by Slonimsky and Shalem (2005: 86):

- *a propensity towards verbatim reproduction or plagiarism in essays;*
- *a propensity to describe rather than analyse, and to offer tautologies in place of justification;*
- *a propensity to focus on examples (tokens) rather than on principles (types) and the relation between them;*
- *a propensity to write from a highly subjective viewpoint without depersonalising;*
- *a propensity to be prescriptive or normative when asked to be analytic.*

Similarly, it is well known that, in subjects such as Mathematics and Physical Science, teaching in schools often focuses on algorithms, standard forms and procedural knowledge that bring success in examinations, including the NSC, but do not sufficiently develop the reasoning, conceptual and theoretical knowledge that is the basis for learning in higher education. This leads to the situation where university lecturers sometimes consider it necessary to assist students to ‘unlearn’ material or approaches that brought them success at school. This problem affects students from a range of schools, including some with a high reputation, but is exacerbated among those from poor schooling backgrounds.

While underpreparedness resulting from inadequate schooling does not imply lack of intellectual capacity, the ways in which it is manifested can lead academic staff (and other students) to equate the two. Underpreparedness thus means different things to different people. For some, those affected by underpreparedness are ‘weak’ students, implying some level of cognitive deficit, and the requirement is remedial education in appropriate sites. For others, underpreparedness is equated with a fundamental lack of ability to grasp higher learning, and those affected are seen as not being ‘university material’. Furthermore, underpreparedness is commonly associated with African students, given the poor quality of schooling experienced in most African communities.

The performance patterns in the cohort studies outlined in Chapter 3 challenge this perception and indeed any uncritical belief in the high quality of white education historically. The fact that on average only 44% of white students graduate in regulation time, and moreover that 33% drop out by the end of regulation time, indicates that underpreparedness cuts across the racial divides of South African society.

In fact, underpreparedness and its damaging effect on student success is not a new phenomenon in South African higher education. While reliable records of completion rates do not go back to the last century, concerns about attrition date back at least as far as the late 1960s. One of the terms of reference of the Van Wyk de Vries Commission of Enquiry into 'universities for Whites', established in 1968 by the then-Minister of National Education, was to inquire into and report on 'the main reasons for, and measures to check, the high failure rate among undergraduate students' (Nupen 1973: 2). As a result of the same concern, a number of South African universities introduced units or 'bureaux' for university teaching in the 1970s. It is clear that there was disquiet about the school-university transition even when the intake was very small, racially exclusive, largely homogeneous and advantaged. The nature and causes of the perceived problem are not clear, but the issue arose in a period of some widening of access in the then predominantly white student body. The purpose of the 'bureaux', to improve university teaching, suggests that the standard teaching and learning process was not yielding the desired results.

The issue of underpreparedness and its consequences in South Africa gained renewed attention in the 1980s, when the participation of black students began to grow. In response, Academic Support and subsequently Academic Development units were established, expanded across the sector, and have continued to focus on addressing the problems of transition between schooling and higher education as a key barrier to learning. A strategy for this has been the introduction of extended curriculum programmes, which are discussed in Chapter 5.

As a key obstacle, underpreparedness warrants serious attention. In particular, it is important to challenge the equating of underpreparedness with lack of ability; this view is not compatible with the reality that, in terms of learning achievement, the large majority of the youth in higher education are in the top decile of their age-group and have the potential to succeed. However, a critical feature of underpreparedness is that it masks such potential.

In fact, closer reading indicates that, in its essential meaning, underpreparedness is a relative concept. A necessary consideration is what it is that students are underprepared for. What can be said with confidence is that many in the intake are underprepared for the traditional forms of higher education at present offered in South Africa. However, given the potential of the intake, and despite the performance patterns, it cannot be said that the underprepared majority of the student body are not capable of higher learning.

As longstanding debate has indicated, underpreparedness as a concept has limited meaning and value as it does not take proper account of the structural faults in the education system that have given rise to it. The following section discusses an alternative way of understanding the problem of South Africa's low-participation, high-attrition system; that is, through the concept of the articulation gap.

4.4 The significance of the ‘articulation gap’ as an obstacle to student success

The concept of the articulation gap

As argued above, underpreparedness is relative to the nature and level of the education concerned. In the South African context, the conundrum of widespread poor performance among the top echelons of the youth is better explained by the concept of the ‘articulation gap’ – that is, the mismatch or discontinuity between the exit level of secondary education and the entry level of higher education. Educational discontinuities exist at various levels in a range of systems, but in the South African case the secondary-tertiary articulation gap seriously affects the majority of the higher education intake, and hence needs to be recognised as a key systemic fault, requiring systemic change.

The articulation gap has been identified as a major cause of student failure and dropout – most negatively affecting students from disadvantaged educational backgrounds – in a range of analyses for over two decades in South Africa. This is confirmed by the cohort analysis in Chapter 2, which shows the shortage of well-prepared candidates for higher education, high first-year attrition, low rates of graduation in regulation time, and poor completion rates overall, which are all pointers to the existence of the articulation gap. The significance of this analysis is that it indicates that the articulation gap has widespread effects on the student body as a whole. If the academic challenge of higher education defeats a high proportion of a small intake, it indicates a quite abnormal discontinuity between school and university.

The negative effects of the articulation gap on student success and equity have been recognised for a long time. In higher education institutions, the establishment of foundational courses and extended programmes goes back three decades. As noted earlier, the articulation gap was recognised in state policy in the Higher Education White Paper of 1997 (DoE 1997:2.34). The role of extended programmes in addressing the articulation gap was confirmed in the 2001 National Plan for Higher Education (DoE 2001: 2.3.2) and this was given practical effect through the establishment of the Foundation Provision Grant scheme in 2004. However, extended programmes in their present form can serve only a minority of students – about 15% of the first-time entering intake – and wider systemic responses to the articulation gap have not yet been put in place.

The nature of the articulation gap

Secondary-tertiary articulation gaps occur in a range of countries and are commonly associated with significant expansion in higher education, particularly where elitism in access gives way to greater inclusiveness. In South Africa, the significance of this systemic fault has increased not only because of enrolment growth (and a consequent reduction in the average level of preparedness of the student intake, possibly exacerbated by loss of quality in schooling) but also because of a major increase in the diversity of the student body in terms of educational, social and linguistic background. Diversity can be enriching, but in South Africa key forms of diversity are rooted in inequalities, and are an obstacle to equity and development.

Moreover, as the performance patterns show, the articulation gap impacts negatively on students from a range of backgrounds, evidently because it has widened. Moving up to a new educational level should always pose significant intellectual challenges to students, but to be effective the challenges need to be realistic, building constructively on prior learning. Too wide a gap undermines learning. The articulation gap in South Africa, which affects so many of the country's academically talented youth, is anomalous and counter-productive to the goal of realising potential.

Owing to diversity and inequalities, the articulation gap is complex. It involves not only subject knowledge but also academic skills and literacies (such as quantitative, language-related and information literacies), approaches to study, background or contextual knowledge required in different disciplines, and forms of social capital. The focus here is on its academic dimensions but it is clearly exacerbated by the social and cultural transition difficulties that many students experience on entering university.

In terms of student performance, the articulation gap is manifested as underpreparedness, in ways like those mentioned above: superficial engagement with texts, inadequate conceptual development, over-reliance on procedural rather than declarative knowledge, and lack of experience of deep rather than surface learning. Understandably, such manifestations are most visible at entry level, in the transition from school, but critical curriculum analysis in recent years has uncovered other key transitions, higher up the curriculum, for which students are also differentially prepared as a result of their backgrounds. These transitions constitute new obstacles to progression, usually for the same students as are most affected by the articulation gap at entry level. Apart from theoretical research on this phenomenon, exemplar curricula commissioned for this investigation have identified such transitions as significant obstacles to learning for many students, and devised approaches to addressing them (see Chapter 7).

The transitions vary in nature, from step-changes in complexity in disciplinary knowledge to key shifts in knowledge domains in professional programmes. One of the clearest examples of the latter is the Engineering degree curriculum, which incorporates four or five major transitions, such as from basic sciences through engineering sciences to design and complex problem management. (This is discussed in detail in Section 7.6.) Such transitions can derail students' studies if they are not recognised and addressed. They represent a form of articulation gap – reflecting not so much the direct school-university gap as a mismatch between the knowledge that is taken for granted throughout standard curricula and what students have actually acquired in their prior formal and informal learning.

The complexity of the articulation gap and associated systemic problems indicates that re-doing school work, using current secondary-level approaches, is not a promising way of addressing the issue. It is of course the case that many students – especially those from strong educational backgrounds – are able to make the transition to higher education successfully, but even more are not, as the performance patterns show. The negative effects of the gap show themselves not only in failure to graduate but also in many students achieving only very marginal passes, never mastering their disciplines.

The significance and nature of the articulation gap call for concerted responses of a systemic nature. The problem is not amenable to solution by superficial or peripheral means. Understanding

its dimensions is essential both for developing interventions that can mitigate it and also for determining where such interventions can best be located.

Focusing only on the deficiencies of schooling is to overlook the other key dimension of the articulation gap, that is, the appropriateness of the starting points and other assumptions underlying higher education curricula for the South African context. The essence of a gap is that it can be bridged from either side, or ideally from both – in this case, through strengthening the outcomes of secondary education and improving the responsiveness of the educational process in higher education. To assess the possibilities, it is necessary to examine the contributions that the different education sectors can realistically be expected to make to narrowing the articulation gap.

4.5 Narrowing the articulation gap: Prospects for the school sector

As discussed earlier, it is clear that conditions beyond the control of higher education, especially socio-economic factors and poor schooling, greatly influence access to and success in higher education. However, if the higher education sector, and the stakeholders who depend on graduate output, are to rely on improvement in these external factors to remove the obstacles, it is important to assess the extent to which such improvement is achievable. This section focuses on the secondary education sector.

It is common cause that the shortcomings and inequalities in South Africa's public school system are a major contributor to the generally poor and racially skewed performance in higher education. There is equally no doubt about the need to improve the effectiveness of schooling, as an end in itself and as a means of enabling growth in higher education. However, the degree to which this is likely to be accomplished, and the timeframe required for substantial improvement, must be key factors in considering what the secondary sector's contribution can be.

If student underpreparedness is seen as a primary cause of poor performance in higher education, the key pragmatic question for assessing the prospects for improvement is: To what extent will the secondary education sector be able to produce well-prepared candidates for higher education in sufficient numbers to enable higher education to function successfully within its current curriculum structures and educational approaches?

It is important to quantify this matter, to get a sense of the scale of the challenge. This means determining the number of well-prepared students the higher education sector needs to enrol annually, which would represent the minimum target for the school sector, and comparing this with the number of well-prepared candidates that the schools are actually producing.

Because of the comprehensive data available on the 2006 cohort, it is useful to take that year as a base. In 2006, the total first-time entering enrolment in higher education was approximately 150,000. If 'well-prepared' is defined as being able to graduate in regulation time, the proportion of the intake in this category, excluding UNISA students, was about 27%, which translates to about 40,000 students. If the definition is stretched to include contact students who take one extra year to graduate, the proportion rises to about 42%, or 63,000 students. Therefore, broadly speaking,

the school sector would have needed to produce between twice and three times as many well-prepared secondary graduates (at least 80,000 additional high-achievers) to provide higher education with a sufficiently well-prepared intake to enable it to produce satisfactory completion rates within its existing teaching and learning process.

Total higher education enrolment is likely to reach close to one million in 2014, with the number of entrants being over 200,000. This means that the secondary sector would need to produce considerably more than 100,000 additional well-prepared candidates for higher education.

The prospects of this being achieved in the foreseeable future are poor. As Spaul (2012) states, 'It is without question that ... South Africa's schooling system remains dysfunctional in that it lacks the ability to educate most of the youth. Every survey that we have testifies to this fact.'

Some indicators of the poor prospects are as follows:

- South African schooling is unusually poor in relation to comparator countries' systems. There is considerable evidence that this is the case, from early primary schooling onwards. The evidence includes: internationally benchmarked learner assessments such as TIMSS (Reddy *et al.* 2013) and surveys such as the World Economic Forum's Global Information Technology Report (WEF 2013), which have seen South Africa placed very low, even in relation to other African countries with a fraction of South Africa's resources;¹³ the Annual National Assessments (ANAs) of literacy and numeracy, which point to alarmingly low levels of achievement in the fundamental building blocks of learning (DBE 2011); and analyses of national school-leaving examinations, indicating low 'challenge levels' in key subjects. (See Scott *et al.* 2007: 31-37 for more detailed discussion and further references.) The extent to which recent secondary curriculum changes and the new National Senior Certificate are contributing to the quality of upper secondary schooling cannot yet be determined conclusively, but early experience of first-year undergraduate performance in Mathematics and Science is not encouraging.

Since South Africa is behind comparator countries, it should theoretically have the resources to improve, at least up to the level of its peer systems. However, there are few, if any, convincing indications that the system is on an upward trajectory in terms of quality of learning, or of how long it might take to secure improvement of the kind and order that higher education would need. As noted earlier, analysts are not confident of such improvement, and suggest timeframes of a generation for a real turnaround.

- An important consideration is the extent to which South Africa's developing-country realities will constrain the long-term, steady-state capacity of the school system to meet higher education's current requirements. As noted earlier, the structure and assumptions of the core degrees were set many decades ago, predicated on a largely homogeneous intake with middle-class cultural capital and mother tongue as the language of instruction. It seems unjustified to expect the school system, now serving highly diverse communities and operating with the limited resources associated with less-industrialised countries, to

¹³ For example, the World Economic Forum's 2013 Global Information Technology Report ranks South Africa at number 140 of 144 countries in terms of the 'quality of the educational system' (with reference to 'meeting the needs of a competitive economy'), below all other African countries surveyed except Burundi and Libya (WEF 2013:324).

produce much larger numbers of matriculants with the same level of preparation as was expected of a small, highly-selected minority in the past.

- While small relative to the youth population, the number of NSC 'Bachelor passes' and 'Diploma passes', which are statutory minimum requirements for entry into degree and diploma programmes respectively, can give a misleading impression of the number of candidates who should be able to participate successfully in higher education. In the 2012 NSC examinations some 136,000 candidates obtained Bachelor passes, as against an estimated 2013 intake into degree programmes of about 120,000. A further 153,000 candidates obtained Diploma passes, against an estimated 2013 diploma intake of under 100,000 (Department of Basic Education 2013). However, the higher education performance patterns indicate that the majority of the statutorily qualified students – including a very large majority of those with Diploma passes – are not well-prepared for current higher education programmes. The challenge lies, therefore, not in statutory qualification but in the extent to which the school system can raise the level of preparedness of these students.
- In particular, school performance in Mathematics and Physical Science is a major obstacle to both access to and success in SET and professional programmes. In terms of the quality of Mathematics and Science education, the World Economic Forum's 2012 Financial Development Report ranks South Africa last among the 62 countries surveyed (WEF 2012: 330), and the ranking in its 2013 Global Information Technology Report is second-last out of 144 countries, above only Yemen (WEF 2013: 325).
- Mathematics is particularly critical because of the range of programmes that require it. The number of Mathematics passes at 40% and above (many of which are inadequate for higher education success) remains well below the current intake needs (Fisher and Scott 2011: 13). This impedes successful growth in many programmes that are important for economic development.

In the wider interests of development and stability as well as individual fulfilment, it is essential that the state and civil society should put special effort into improving schooling over the next decade, and the country must expect progress. However, given the current situation in schooling, it is not plausible that this sector can be depended upon to close the articulation gap.

4.6 Narrowing the articulation gap: Prospects for the FET College sector

Since there is a view in various quarters that the emerging FET colleges sector should have a major role in preparing students for higher education, and even in offering forms of higher education provision, it is necessary to consider the prospects of the college sector in contributing to addressing the articulation gap.

The idea of introducing an 'intermediate' college sector in South Africa, designed partly to be a feeder to traditional higher education, gained currency over two decades ago,¹⁴ and has

¹⁴ The motivations behind proposals for a college system in the latter years of the apartheid era were varied. On one hand there was the 'Education Strategy' produced by the Heads of Education Departments of the outgoing regime,

continued to be advocated in various forms. Often arising from the perceived role of the North American community college, the idea is attractive to many academics, commonly because it is seen to offer a way of bridging the school-university articulation gap that entails no change in higher education structures and practices. In this sense, colleges would be expected to take on preparation responsibilities that the school system is unable to discharge. Intermediate qualifications which could be offered by colleges (along the lines of the American two-year Associate Bachelor's) are seen as a way of recognising junior course credits obtained by students who are not able to complete a full degree or diploma, or as a route into higher education in mid-degree or mid-diploma.

The current DHET effort to develop a modernised FET college system out of the struggling Technical College sector has provided new stimulus for this discussion. The central purpose of the proposals to restructure the FET colleges is to provide intermediate vocational education and training, with a growing emphasis on producing artisans (DHET 2010a: 26). In the words of the Green Paper:

Our vision for the public FET colleges is one of vibrant institutions that offer vocational and occupational qualifications, mainly to young people (16 to 24 years old). They will be the primary site for vocational skills development for artisans and other occupations at a similar level... (DHET 2012a: 21).

Hence the colleges are expected 'to primarily offer two types of qualifications': the National Certificate Vocational (NCV), a general vocational qualification at upper secondary level; and 'N' courses, which provide the theoretical and sometimes practical components of apprenticeships and learnerships. The Green Paper encourages colleges with the necessary capacity and relationships with higher education to establish articulation with universities and universities of technology, and provides for co-operation with the latter, over time, in the offering of Higher Certificates and forms of bridging and foundational provision. The Green Paper also allows for a range of other pre-higher education provision in the colleges, from adult basic education to customised short courses (DHET 2012a: 21-24).

There are thus a range of possibilities within current DHET policy, as well as in expectations among other interested parties. There is consequently a risk that, as an emerging sector without established parameters of practice, FET colleges will undertake or be pressured to undertake too wide a range of functions, and dilute the effectiveness of their contributions overall. This risk does not appear to have been adequately addressed in policy yet. The view that the FET college sector could take on a broader community college role, absorbing the bulk of underprepared students who are currently entering higher education and sifting out those who can progress to mainstream undergraduate study, must be assessed accordingly.

which proposed the establishment of 'Edukons' which would essentially divert disadvantaged black students away from the universities and into 'preparatory and remedial instruction' in separate colleges (DNE 1991). On the other end of the spectrum were proposals, notably from the then-University of Natal, for college-type structures *within* universities, offering foundational provision that would be articulated with regular degrees (University of Natal 1990). Issues concerning FET colleges taking over certain roles from higher education remain current (see for example Cosser 2010).

There is clearly value to be gained from a vigorous and effective FET college sector. The key question for this investigation, however, is whether such a development would remove the need for structural reform in higher education. There are pragmatic and principled arguments for this not being the case. The pragmatic considerations include the following:

- There is little prospect, for the foreseeable future, of the FET sector being able to take on wider functions than the vocational education and training it is primarily designed to provide (DHET 2010a: 26). The sector faces major challenges in developing to a point where it can successfully fulfil this primary mandate with a modest student intake, and thereafter expand in numbers. The challenge is increased by the ambitious growth targets proposed in the Green Paper, which envisages '4 000 000 enrolments (approximately a 60% participation rate) in colleges and other [non-university] post-school institutions' (DHET 2012a: x).
- The challenges for the FET college sector are acknowledged by the DHET and other bodies to be large-scale and complex. DHET has observed that the sector is

[the] sub-system that is the most fragile in the complex and incomplete transitions it has experienced in recent years, and in its new location in the post-school education and training system (DHET 2011: 39).

According to an HSRC report, 'The findings of a 2010 audit of the Further Education and Training (FET) college sector reveal a sector in disarray' (Cosser 2012a). Among the challenges that the sector faces are chronic shortages of qualified and experienced staff, very low student success rates,¹⁵ inadequate infrastructure and equipment, poorly developed links with business and industry, limited funding in relation to the scale of current and future needs, and students that generally have very poor educational histories.

- In terms of producing well-prepared candidates for higher education, the FET colleges sector has considerably less capacity than the school sector. In addition to the general situation outlined above, college staff members are not geared to delivering standard 'academic' secondary education. Moreover, in terms of conventional academic achievement, the colleges' student intake is, and is likely to continue to be, at a lower level than the school learners who represent the pool of candidates for higher education. The conclusion is that the colleges sector cannot be expected to contribute on any scale to producing the 100,000 well-prepared secondary graduates that higher education would need in order to justify maintaining the status quo in the teaching and learning process.
- While a small number of FET colleges have better capacity, the situation of the sector overall strongly points to the need for it to focus on developing its core business. To become a substantial feeder to a reasonable range of higher education qualifications and subject areas, even through offering foundational courses at the levels currently provided in the higher education sector, FET colleges would need to recruit a whole new academic staff

¹⁵ In 2010, there was an enrolment of fewer than 300,000 in NC(V) and 'N' courses combined. The average throughput (or course completion) rates for 2007-2009 for these two core qualifications were 30% and 47% respectively (Cosser 2012b).

complement, acquire more sophisticated equipment and facilities, and deliver and quality-assure complex provision.

Such expansion of role, on any significant scale, cannot reasonably be expected in prevailing circumstances or for the foreseeable future.

Aside from these pragmatic considerations, the matter of access routes into higher education has important social as well as policy and efficiency ramifications. The key question is: What proportion of the youth should the higher education sector be able to accept directly from secondary education? In the interests of its becoming an effectively functioning modern system in an emerging economy, South African higher education should be able to cater effectively for a higher proportion of school-leavers than it is currently managing to do. It should be recalled that only about 7% of all South African youth, and 5% of African and coloured youth, are currently being successfully accommodated.

If the reasonable and necessary goal of reaching a higher education GER of at least 20% is to be achieved, together with improved completion rates, the sector needs to work towards providing direct admission, as well as appropriate curricula and support, to at least the top 15% of school-leavers, including equitable proportions of students from all population groups. Channelling all underprepared students via FET colleges, as is sometimes proposed, would be artificial, probably inefficient because it would introduce additional selection and admissions hurdles, and certainly not equitable, since the majority of talented but underprepared students are from the African and coloured groups. The key goals of increasing graduate output and equity of outcomes would not be served if top-decile matriculants from township and rural schools were required to follow a circuitous route through an FET college in order to gain access to higher education proper, and to a curriculum that enabled them to realise their potential.

In summary, well-functioning FET colleges would add much value to the education system by focusing unequivocally on their central mission of providing good quality post-school technical and vocational education and training, and in the process offering educational opportunities for out-of-school youth, catering for mature adults wishing to re-enter formal education, and meeting local community education needs. However, expecting FET colleges also to shoulder the responsibility of preparing large numbers of students for higher education programmes is not feasible or desirable.

Developing the college sector is therefore not a substitute for higher education taking responsibility for addressing the articulation gap.

4.7 Narrowing the articulation gap: Responsibilities of the higher education sector

As noted earlier, many attribute the poor performance in higher education exclusively to factors that are outside of the higher education sector's control, and take the view that higher education should not have to compensate for poor schooling. However, the conclusion of this investigation's analysis is that improvement in external factors cannot be relied on to improve higher education

performance, and there is no substitute for the higher education sector undertaking reform within itself, if performance is to be substantially raised. This is recognised in the DHET Revised Strategic Plan:

The poor performance of the schooling system is a major systemic constraint to success in the university system. Access to programmes with specialised entry requirements is a major concern to universities, as is the under-preparedness of students and the consequent high drop-out and poor completion rates. This is wasteful of private and institutional resources and energies. This context requires well thought through and coherent institutional responses that increase the internal efficiency of universities and address racial disparities in these efficiencies, rather than ad hoc responses. Not only must completion rates be improved, but there must be a systemic focus on the production of high quality graduates. We need to identify and produce students who have the potential to become the new generation of academics and researchers (DHET, 2011: 37).

The pragmatic case is that, if higher education does not bring about systemic reforms within its teaching and learning system, the status quo will largely remain, to the detriment of development, equity and individual advancement. It is also critical to recognise that substantially increasing the numbers and quality of graduates is essential for improving the effectiveness of all forms of education, since it is current graduates that will make up the next generation of school teachers and college lecturers, as well as academic staff. If this goal is not achieved – because higher education puts the onus for change on other sectors and is not willing to take the responsibility itself – the vicious circle of lack of expertise in schools and colleges, resulting in an underprepared higher education intake, will be perpetuated.

There is also a principled case. Provided that reform does not undermine the academic project, it is reasonable to ask the higher education sector to be willing to review and modify its structures and processes, to adjust to the social and educational conditions of the country by coming to terms with the realities of the student body it needs to serve. This would represent a significant contribution to transformation and development.

It should be emphasised that higher education is being called on to respond to the learning needs of only the top stratum of school leavers – the top 15%-20% of the youth even if there is significant growth. It should be possible for the sector to adjust to the realities of this high-potential group even if many of them are not well-prepared for existing mainstream programmes.

To respond to this need, higher education has an obligation to do whatever is in its control to facilitate substantial improvement in student performance and in equity of outcomes. Key factors affecting student performance that are within higher education's control include institutional culture, with its implications for student motivation and engagement, and the educational process in higher education itself, which is the subject of this investigation.

The structure and assumptions of the curriculum are a fundamental element of the educational process. The need for higher education to take responsibility for addressing the direct secondary-tertiary articulation gap has been recognised in policy since the time of the 1997 White Paper

(DoE 1997: 2.34). More recently, the analysis of performance patterns that has informed this report has made a case for this to be undertaken as mainstream curriculum reform – not through interventions on the margins – because it would benefit the majority of students. Moreover, the identification of transitions within curricula that impede large numbers of students has highlighted the need for coherent reform of curricula as a whole, not only at entry level. This is unequivocally a higher education responsibility.

In summary, if the performance patterns are to be substantially improved, higher education curriculum development needs to take account of the major systemic problems that have emerged, not only at the school-university interface but in curricula as a whole. Chapter 6 outlines a case for structural curriculum reform in higher education that is designed to enable the sector to address the needs of the full range of the student body, and thereby substantially increase the success of its current intake and establish a responsible base for growth. **The central element of the proposed reform is creating additional curriculum space for strengthening and enhancing learning in mainstream undergraduate provision. In practice, the means of enabling this is to lengthen the duration of the core programmes as the norm.**

Before considering the case for this, it is useful to review the experience gained from the extended curriculum programme initiative in South Africa, which is relevant to analysing approaches to improving graduate output.

5. Extended curriculum programmes: Experience and lessons

Chapter Overview

Extended curriculum programmes – now commonly known just as extended programmes – are a South African higher education intervention with much significance for the case for structural curriculum reform. Extended programmes have been in existence in various forms for three decades, and much experience has been gained. The relevance of this initiative is that it has constituted a curriculum reform intervention which, though limited in scope and reach, has been designed to deal with systemic obstacles to equity and student success, particularly through addressing the articulation gap. Experience with extended programmes therefore represents an element of the case for wider curriculum reform, and lessons derived from it can inform proposals for systemic change.

This chapter provides a brief history of the development of the intervention and the constraints that have affected it. It then discusses evidence for the success of such programmes, quantitative and qualitative, with respect to both increasing access and improving student performance. The chapter concludes that, notwithstanding evidence of progress and success, the benefits of curriculum extension will not be fully realised until it is taken to scale and becomes an integral element of mainstream provision.

5.1 Introduction: Purpose, role and limitations of extended programme initiatives

Purpose and role

The purpose of extended programmes is to create the curriculum space needed to enable talented but underprepared students to achieve sound foundations for success in higher education. Extended programmes are variants of regular undergraduate degree and diploma programmes that extend their duration, usually by a year, to enable substantial foundational provision to be incorporated. The foundational provision can take various forms, particularly introductory courses in key subjects as well as provision that enables students to develop essential academic literacies and learning skills in areas such as academic argument and analysis, advanced reading and writing competences, numeracy, and information literacy.

The origins of extended programmes lie in the early 1980s, when foundational courses began to be developed in some historically advantaged universities in response to opportunities to widen access. Academic Development (AD) programmes, known then as Academic Support programmes, aimed to create access opportunities and support systems for talented but disadvantaged African, coloured and Indian students, whose access to then-white institutions was still severely restricted by law. AD operations were established in the historically disadvantaged institutions somewhat later, with broader briefs focusing particularly on staff development.

The foundation course model was identified as an effective one early on by Academic Support/Development units, after other forms of intervention had been found wanting, particularly in SET subjects. The alternatives at the time mainly took the form of ‘concurrent’ support, such as additional tutorial programmes, which were offered within regular first-year courses. The key drawback of the concurrent model was that it had limited capacity to address the substantial articulation gap experienced by the majority of students from the then-African, coloured and Indian state school systems. This was because it could operate only within the parameters of the regular courses, which were based on assumptions about prior learning that were not appropriate for students from disadvantaged educational backgrounds, irrespective of their potential. Foundational courses were consequently developed as alternatives that could build on the students’ actual prior learning. The success of individual foundation courses, usually offered in core subjects, led to the development of ‘foundation programmes’ comprising coherent sets of foundation courses and other supportive provision such as language development or academic literacy courses. It was only after the political transition that closer integration of foundation programmes and regular curricula led to the concept of extended curriculum programmes, which are defined as whole degree or diploma programmes into which substantial foundational provision is incorporated.

The role of extended programmes in facilitating student success has been central in government policy and was formally recognised in the 1997 White Paper (DoE 1997: 2.34), reaffirmed in the National Plan for Higher Education in 2001 (DoE 2001: 2.3.2) and recognised for funding purposes in the new funding framework introduced in 2004. Substantial state funding has since been provided, with the result that almost all higher education institutions have introduced such provision. There has thus been extensive experience of this form of intervention. However, since the expansion of the intervention across the whole higher education sector has occurred only in the last decade, there is major variance in the maturity and resourcing of extended programmes between institutions. They range from programmes that have developed over three decades, with permanent, specialised staff, to new and untested ones taught by part-time staff on short-term contracts.

From the outset, extended programmes have aimed to link access with success by bridging the secondary-tertiary articulation gap. Their twin purposes are:

- To enable access to be widened in a responsible way by offering entry-level provision that can meet the needs of talented but underprepared students. Historically, extended programmes have primarily targeted students who do not meet an institution’s regular admission criteria, though their envisaged purpose goes well beyond this (DHET 2012b).
- To provide students who are underprepared for standard first-year courses with sound academic foundations that help close the articulation gap and enable them to succeed in completing their studies. The provision of access has, however, often not been adequately followed through with strategies to promote effective learning later in the curriculum.

In short, extended programmes have sought to provide an alternative curriculum structure geared to the needs of talented students who have not been well served by existing mainstream curricula and their underlying assumptions. They have in fact represented the only intervention thus far that has been designed to offer a systemic solution to the systemic problem of the articulation

gap. Their purpose is thus similar to that of the broader structural reform that is the subject of this report, so experience gained from extended programmes is a key consideration in the case for modifying the curriculum structure.

Limitations

Before the performance of extended programmes is assessed, it is necessary to note the constraints that have affected this intervention, which include the following.

- Because the foundational provision in an extended programme has to be grafted on to a rigid traditional curriculum, there are substantial design difficulties, leading commonly to undesirable discontinuities in key subjects, step-changes in complexity and volume of work, insufficient opportunity for integrating knowledge and skills development, and lack of coherence and reinforcement across disciplines.
- For the same reason, the only systemic problem that extended programmes can effectively address is the secondary-tertiary articulation gap. This is a crucial fault-line to address but it is not the only one of its kind. As discussed more fully in Chapter 6, many curricula involve key transitions, preparedness for which is assumed in current programmes. However, these assumptions are not appropriate for a high proportion of the intake. This is reflected in the fact that one of the most common constraints on the progression of extended programme students lies in step-changes between mainstream courses.
- As noted earlier, despite more enabling state policy, institutions have used extended programmes predominantly as a mechanism for widening access for students who do not meet regular admission criteria. This has been valid as an equity practice in selective institutions but questionable in many cases where regular entry requirements are low and where the students admitted have been so underprepared as to have a very low probability of succeeding (DHET 2012b). In any event, the effect of this practice is that, in virtually all programmes, the extended programme students are significantly less prepared and more at-risk than the regular intake. This should be taken into account in assessing extended programme performance.
- The biggest overall limitation of extended programmes is that they have been an intervention for a minority of students when, as the performance patterns indicate, structural innovation of this kind is needed for the majority of the intake. The current funding provision allows for only about 15% of the intake to benefit from extended programmes, restricting their reach. Equally important is the way in which the minority nature of the programmes affects the way they are regarded by institutions, students and other stakeholders (including bursary donors). They are seen to have low status, and are consequently often marginalised academically and administratively. Funding has until recently operated in three-year cycles, so many extended programme teaching staff have been appointed on short-term contracts, with negative consequences for continuity and the professionalisation of these roles. The students on extended programmes have also been affected by the perceived status of the intervention. Research has indicated ambivalence in student attitudes, with recognition of the value of the programmes often tempered by the threat of stigma or stereotyping.

Assessing the effectiveness of extended programmes

Despite these limitations, there is considerable evidence of the success of extended programmes as a systemic intervention, in terms of both key aims, i.e. widening access and improving student performance. The evidence is in two broad categories:

- *Sector-wide quantitative data.* Although state funding for extended programmes began in 2004, it was only in the second funding cycle, in 2007-2009, that the programmes became established in their current form across the sector. It has thus not yet been possible to conduct full cohort studies. However, quantitative data collected by the DHET in recent years provide information on extended programme students' success rates in foundational and regular courses. The success-rate data allow for an assessment of progression and of the effectiveness of foundational provision in addressing the articulation gap.
- *Institution-level case studies combining qualitative and quantitative data.* The implementation of extended programmes across the sector has been extremely uneven. This has been shown in institutional funding applications and confidential reports to the DHET, and in quantitative success data. In these circumstances, sector-wide averages have little meaning. Therefore, in terms of assessing the capacity of the intervention to make a difference, the key question is not just whether extended programmes in general have been successful but also whether there are cases of extended programmes that demonstrate significant success with the intervention, showing its potential to make a difference. The follow-up question is what factors might be responsible for success where it occurs. These questions lend themselves to investigation through case studies or programme evaluations, many of which have been published in journal articles, academic books or other forms. This is a complex topic but Section 5.4 provides a brief overview of four cases by way of example.

5.2 The contribution of extended programmes to widening access

Since 2004, state funding has enabled up to 15% of the first-time entering intake to be admitted to extended programmes. As institutions have used the intervention primarily to provide access for students who have not met regular institutional admission criteria, some 80%-90% of foundation students would not have had an opportunity in higher education without the entry route provided by extended programmes. This amounts to tens of thousands of students, representing a significant proportion of the total undergraduate intake over this period.

The intervention has had particular significance in relation to equity in access, as indicated in the following excerpt from a report recently commissioned by the World Bank:

Extended programs have also played a special role in facilitating equity of access in historically white institutions, especially the research universities, because relatively few black students have been competitive on standard entry criteria. This is particularly the case with SET and business and management programs. An example is the extended science program of the University of KwaZulu-Natal (UKZN), where all entering students did not meet regular entry requirements. The program reports that in a recent year, of the approximately 2,000 African students in the Science Faculty, about 1,400 had gained access through an extended program.

Without these students, 'the Faculty's proportion of Black African students would have dropped from about 50 percent to about 15 percent (in a province which is 85 percent Black African)' (Garraway 2009, 12). There are many other similar cases among extended programs (Fisher and Scott 2011:25).

In addressing the articulation gap, extended programmes are intended to provide access that is meaningful, i.e. not only entry but also the opportunity for students to establish foundations for succeeding. The following section outlines aspects of the performance of students in extended programmes.

5.3 Performance patterns in extended programmes: Sector-wide quantitative data

The quantitative data on extended programmes gathered by the DHET from institutional annual reports cover the period 2007-2011. They take the form of the course success rates¹⁶ of 'foundation students' (that is, students enrolled in an extended programme) in both approved foundational courses and regular courses.¹⁷ Separate data are available for foundation students who were first-time entrants and those who were continuing students (i.e. foundation students continuing their studies after completing Year 1 of the extended programme).

With the permission of the DHET, which supplied the raw data, the CHE commissioned an analysis of foundation students' success rates over the period. The analysis included aggregating and grouping the data in various ways with a view to identifying performance patterns. Thus the data were aggregated across years, to capture the two funding cycles in this period, and were also grouped in broad subject clusters, viz. SET, Commerce and Humanities.

Since information on performance at institutional level is taken as confidential at present, the data presented here are at a high level. This, together with the uneven quality of extended programme implementation noted earlier, means that there needs to be caution in drawing conclusions. However, the analysis is regarded as having value in that it compares foundation students' performance in foundational and regular courses, albeit broadly. This relationship can indicate the following:

- The standard of foundational provision. It can be expected that performance in foundational provision will be somewhat higher than in regular courses because of the former's focus on foundational learning and skills, and related pedagogical support. However, if students did far better in foundation than in regular courses, there would be a concern about whether the foundation courses were sufficiently demanding intellectually.

¹⁶ (FTE) course success rates represent the percentage of students enrolled for a course who pass that course (or module). For the sake of brevity, they are referred to as 'success rates' in this document.

¹⁷ Different extended programme models involve different combinations of foundation and regular courses. In one model, the students do only foundation courses in Year 1, and only regular courses from Year 2 onwards. In other models, the students do various mixes of foundation and regular courses in Year 1 and beyond. The proportions of foundation and regular courses in any given year of an extended programme thus vary considerably from programme to programme. However, the proportion of foundation courses usually declines sharply after Year 1.

- The extent to which the foundation courses have prepared students for regular provision. This can be thought of in two ways: whether foundational provision has addressed the school-university articulation gap; and whether there is effective articulation between the foundation and regular courses in the curriculum. Again, large discrepancies in performance between foundation and regular courses would raise concerns about the theory or practice of the intervention.

An outline of key patterns arising from the analysis is given below. Because both the data collection and the programmes themselves have taken time to stabilise, there is a particular focus here on the latter years of the period, 2010 and 2011, which were the first two years of the latest funding cycle.

Overall observation: The range of performance between institutions

There is considerable variation in success rates between institutions. Excluding UNISA, the average institutional success rate in foundation courses over the five-year period (2007-11) ranged from about 60% to 85%, but in most institutions it was between 70% and 80%. There is a modest upward trend over the period.

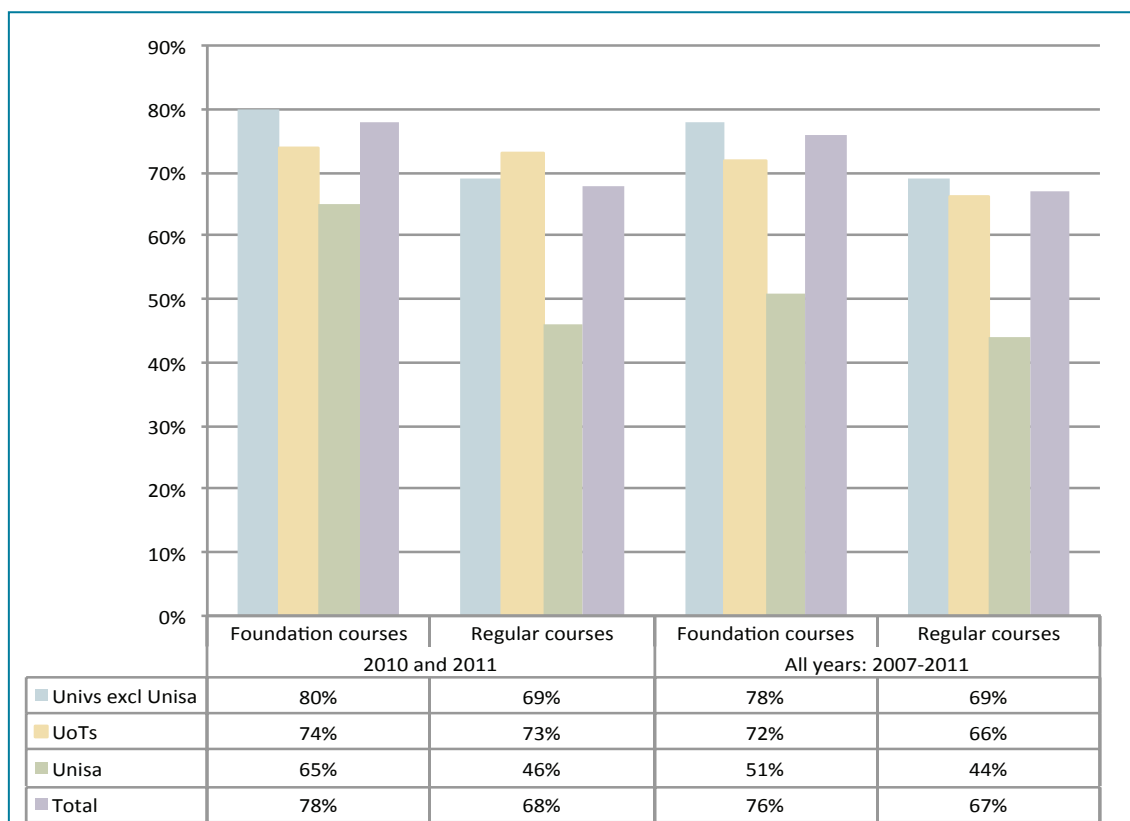
There is wider variation in foundation students' performance in regular courses. The range for first-time entering students is from about 45% to 85%. However, the pattern is much more positive for continuing foundation students, who take a high proportion of regular courses. In the case of these students, only seven institutions had success rates below 70% (including only one below 60%), and in three institutions they were about 80%.

The variation in success rates shows no clear patterning by institutional type (except that first-time entering foundation students in historically disadvantaged universities do somewhat better in regular courses than their counterparts in other institutions). This appears to support the qualitative evidence of highly uneven implementation of extended programmes across the sector, rather than to suggest fundamental flaws in the model.

Performance of first-time entering foundation students

Figure 2 shows the success rates of foundation students in the first year of their extended programme, in the foundation courses they have taken and in any regular courses included in their curriculum in their first year.

Figure 2: Success rates of first-time entering foundation students by institution type



The graph and the underlying data show the following:

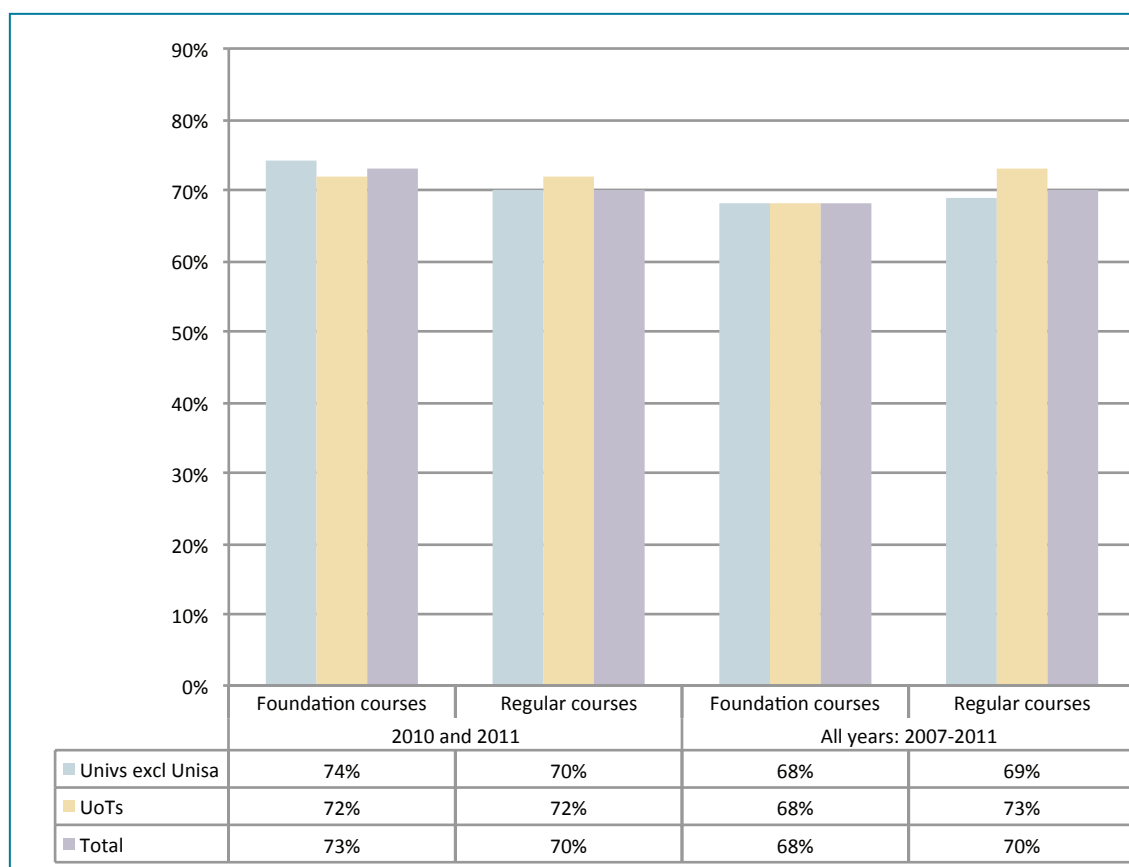
- The success rates have generally been stable over time but show a small upward trend in almost all respects.¹⁸ This is consistent with growth in experience of foundational provision, albeit from a low base in a number of institutions. The UNISA performance brings the sector success rates down by one or two percentage points.
- The DHET has set 10 percentage points as an acceptable difference between foundation course and regular course performance. The data show that this has largely been achieved, indicating that a reasonable standard of intellectual demand is being set in foundation courses.
- The universities of technology have all but closed the gap between foundation course and regular course performance. Institution-level data also show that in a number of universities the gap is under 5 percentage points.
- The underlying FTE enrolment figures show that foundation students are, on average, taking a significant amount of regular coursework in their entry year. Over the five years, of the total enrolment of 37,651 first-time entering FTEs, 13,237 FTEs (35%) were in regular courses. This level of exposure to mainstream provision in the entry year can be positive, but it is possible that underpreparedness for traditional first-year courses may be contributing to the performance gap, particularly in research-orientated universities.

¹⁸ There was a notable decline in performance in 2009. The new National Senior Certificate was written for the first time in 2008, but it is not known if this was a significant factor.

Performance of continuing foundation students

Continuing foundation students (referred to formally by the DHET as ‘returning’ foundation students) are students who entered an Extended Curriculum Programme, were successful enough to be re-admitted, and returned to the institution after Year 1.

Figure 3: Success rates of continuing foundation students by institution type, excluding UNISA¹⁹



The figure and the underlying data available on www.che.ac.za show the following:

- The rates are largely stable over the full five-year period, with a modest upward trend in performance in foundational courses.
- Continuing foundation students' success rates in foundation courses are lower than for first-time entering students. This may arise from a higher level of difficulty in foundational courses offered after the entry year. It should be noted that at this level, the proportion of foundational coursework in the students' curricula is low.
- At this level, the performance gap between foundation and regular courses has largely been eliminated. (The underlying data show that in some cases performance in regular courses has overtaken that in foundation courses, and is significantly stronger in the

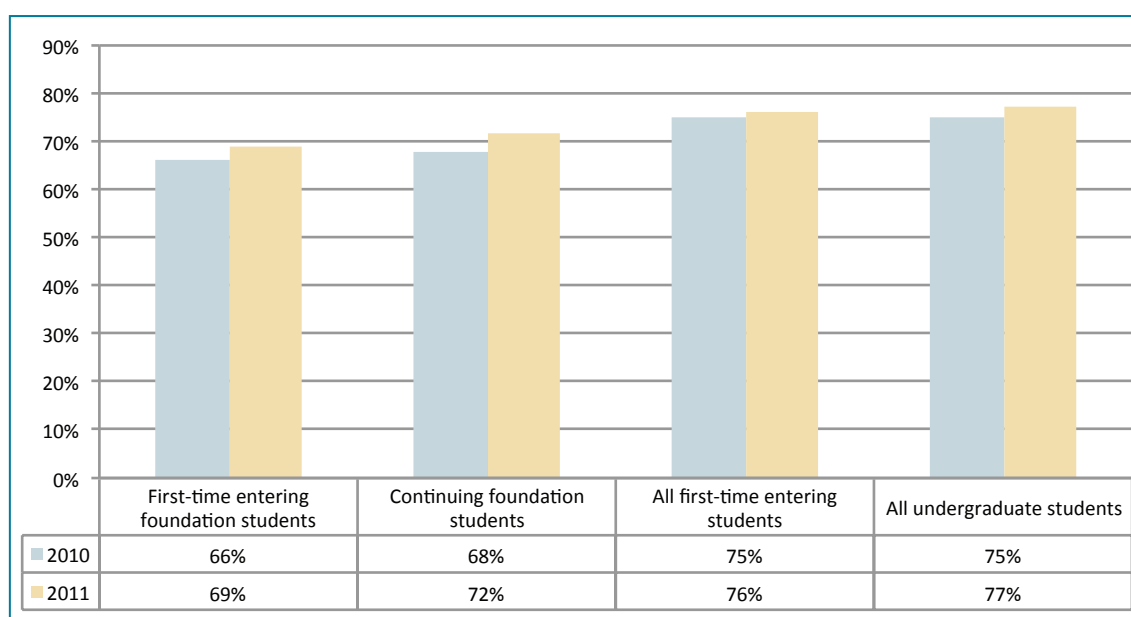
¹⁹ Figures for continuing foundation students at UNISA are not available.

research universities for continuing than for first-time entering foundation students.) This is a positive indicator that foundational provision is of a similar standard to mainstream provision. Its main significance, however, is that it suggests that, for the growing numbers of continuing foundation students (about 40,000 FTEs over the five years, including 13,500 in 2011), the extended programme model has made a key contribution to reducing underpreparedness, enabling foundation students to succeed in mainstream courses, and realising their potential.

Comparison with all undergraduates

As noted earlier, the significance of sector-wide extended programme data is limited by uneven quality of implementation. However, the success rates given in Figure 4 offer approximate comparisons between the performance of foundation students and that of all undergraduates in regular courses.²⁰

Figure 4: Comparison of success rates in regular courses: foundation students and all students: 2010 and 2011



The figure and the underlying data show the following:

- The foundation students' success rates are comparable with those of the whole student body, particularly in view of their different risk profiles. This indicates that, if the articulation gap is addressed, students who are underprepared for existing mainstream curricula are able to perform comparably with their better-prepared peers.
- The institutional data show that in 2011, the first-time entering foundation students' success rate in regular courses was brought below 70% by very poor performance at one large

²⁰ The figures for all students include the foundation students because disaggregated figures are not available. However, since the foundation students represent a small minority (less than 15% of the first-time entering intake), the figures can still be meaningfully compared.

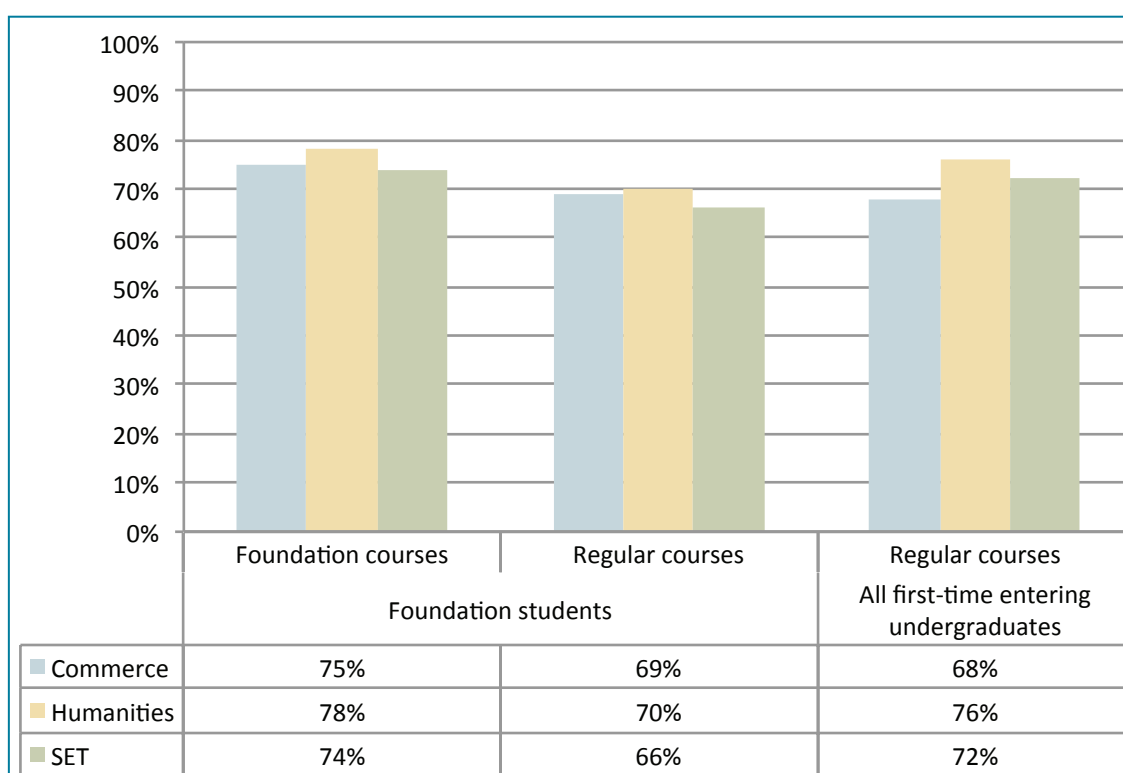
institution, some 30 percentage points below the success rate of all first-time entering students at the institution. Similarly, in 2010 the rate for this category was depressed by exceptionally poor performance in three large universities.

- There is much more variation in institutional success rates for foundation students than for all students. In 2011, in the case of performance in regular courses, seven contact institutions had success rates below 70% for foundation students, whereas there were no contact institutions with rates below 70% for all students. This is a further indicator of uneven implementation of foundational provision across the sector.

Performance in broad subject areas

The DHET uses three broad subject categories for classifying foundation students: Business and Commerce; Humanities; and Science, Engineering and Technology (SET). Figure 5 shows foundation students' performance across these subject areas in comparison with that of all first-time entering students.²¹

Figure 5: Foundation students' success rates, and comparison with all first-time entering students' success rates, by broad subject area: 2011



The figure and the underlying data show the following:

- The foundation students' success rates are consistent across the subject areas, with no more than four percentage points' variance. This is somewhat counter-intuitive since it

²¹ Please note that the term 'foundation students' in this table refers to both entering and continuing foundation students.

is commonly recognised in South Africa that students from educationally disadvantaged backgrounds have particular difficulty with SET and other mathematics-based subjects. It is for this reason that there has been a special focus on extended programmes in the SET area since the 1980s, and this area enjoys double weighting in foundation funding. In recent years, programmes in Business and Commerce have gained increasing prominence and sophistication.

- Foundation student performance in regular courses compares well with that of all first-time entering undergraduates across the three broad subject areas, with the only significant gap being in Humanities. This underlines the value of addressing the articulation gap in enabling underprepared students to realise their potential, particularly in SET and other mathematics-related programme areas.
- The equivalent success rates for 2010 (not shown in the graph) are very similar to those for 2011, but there is a slight improving trend. There was also significant growth in the absolute number of successful foundation student FTEs (in foundation and regular courses) in each of the three subject areas from 2010 to 2011:

Commerce: 38%

Humanities: 23%

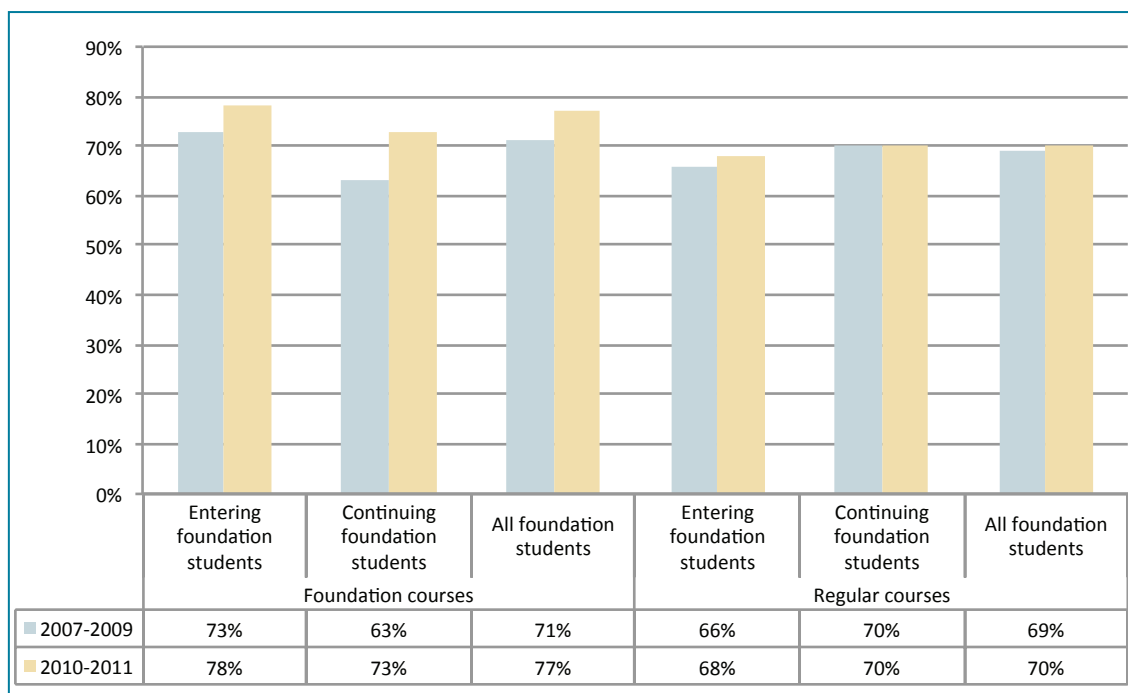
SET: 11%

The growth in Commerce is indicative of the increasing attention given to extended programmes in this area. While the growth rate is lowest in SET, this area still had by the far the highest number of successful FTEs in 2011: 7,403 successful FTEs compared with 4,891 in Commerce and 3,411 in Humanities.

- Growth in successful FTEs has come not only from increased enrolment but also from steady improvement in success rates. Broad performance trends between 2007 and 2011 are outlined below.

Performance across cycles: an improving trend

As noted earlier, the available quantitative data cover the second foundation funding cycle (2007-2009) and two years of the third cycle (2010-2011). There were only minor changes to the foundation grant policy between these cycles. This allows for fair comparison of performance between the cycles, as set out in Figure 6.

Figure 6: Foundation students' success rates by funding cycle: 2007-2009 and 2010-2011

The figure and the underlying data show the following:

- There is steady improvement in success rates in foundation courses, both within and across the cycles. This may be due to growth in experience with and commitment to foundational provision across the system, supported by the growth in foundation grant funding that has occurred. An indirect indication of the maintenance or improvement of standards in foundational provision is that the higher success rates are attributable to modest improvement in many institutions, with major increases (more than 10 percentage points across the cycles) being rare and occurring mainly in institutions where the rates were initially below average.
- Performance in regular courses has remained stable across the cycles. While the rates remain reasonable for the target group, the pattern suggests that articulation between foundational provision and the regular curriculum continues to have shortcomings. However, a positive indicator is the improving trend between 2010 and 2011 noted under Figure 5. It is reasonable to expect this improvement to continue as foundation students benefit from the strengthening of extended programmes that is evidently occurring, and will be further supported by new funding policy, introduced in 2013, that provides for continuing rather than cyclical funding of approved extended programmes (DHET 2012b).
- The positive performance trend has been achieved despite significant growth in FTE enrolment of foundation students. The average annual FTE enrolment grew by 80% from the first to the second cycle (from 11,768 to 21,139 FTEs). Growth from 2007 to 2011 was almost 200% (from 7,541 to 22,565 FTEs). This indicates a growing robustness in the sector's capacity to develop extended curricula.

5.4 Performance patterns in individual programmes

As noted earlier, the performance of individual extended programmes provides a more detailed picture of what can be achieved through structural curriculum change. There are now a considerable number of accounts – some formally published, many in unpublished reports – of extended programmes that have achieved significant success in their contexts. This section offers a brief overview, as well as summary accounts of four individual programmes, to give a sense of the challenges and possibilities in different institutional contexts.

Overview

Despite the inherent design difficulties, foundational provision and extended programmes have demonstrably made a significant difference to student performance in many cases, particularly in SET and Business/Management areas. In addition to individual articles and reports, examples of successful extended programmes covering a range of subjects and institutional contexts have been compiled in Garraway (2009). A recent book, Dhunpath and Vithal (2013), offers accounts of specific programmes at the University of KwaZulu-Natal as well as general analysis of extended programmes as a curriculum intervention.

Broad forms of contribution to student success can be identified. Since extended programme students are significantly more at risk than mainstream entrants, lower performance levels can be expected, even with the additional support offered. Particularly in SET degree programmes that are founded on Mathematics and Physical Science, extended programme attrition rates are often higher than those of African and coloured mainstream students. However, in many cases the extended route makes a substantial contribution to equity. For example, in a UKZN case study, for seven entry cohorts the completion rates for the two Science foundation/extended programmes offered were 63% and 50% respectively, against a mainstream completion rate of about 65% (Garraway, 2009: 17). Given that the extended programmes' share of African enrolment was about 70% in this period, the contribution to absolute African graduate numbers is most significant. An example of such a contribution in a highly selective programme, the MBChB, is provided by Sikakana (2010).²²

There are also a number of cases of extended programme classes outperforming their mainstream peers, in completion rates and in individual subjects. For example, Wits University reports that, for the fourteen entry cohorts up to 2005, the extended BSc completion rate was over 50% compared with just under 50 % for mainstream black students (Garraway, 2009: 8). Similarly, there are cases of extended programme students outperforming the mainstream in individual subject courses with the same final examination, including particularly demanding subjects such as Mathematics, Accounting and Statistics, as outlined in Garraway (2009).

²² This quantitative study provided a significant finding on the capacity of an extended programme to address the articulation gap, concluding that 'Although the retention of ADP [extended programme] students was lower than that of non-ADP students, the ADP enabled those who graduated to overcome the effects of under-resourced schooling and to perform well in final-year examinations' (Sikakana 2010: 917).

A brief account of some of the successful extended degree programmes is provided below.

Management Studies at the University of Johannesburg

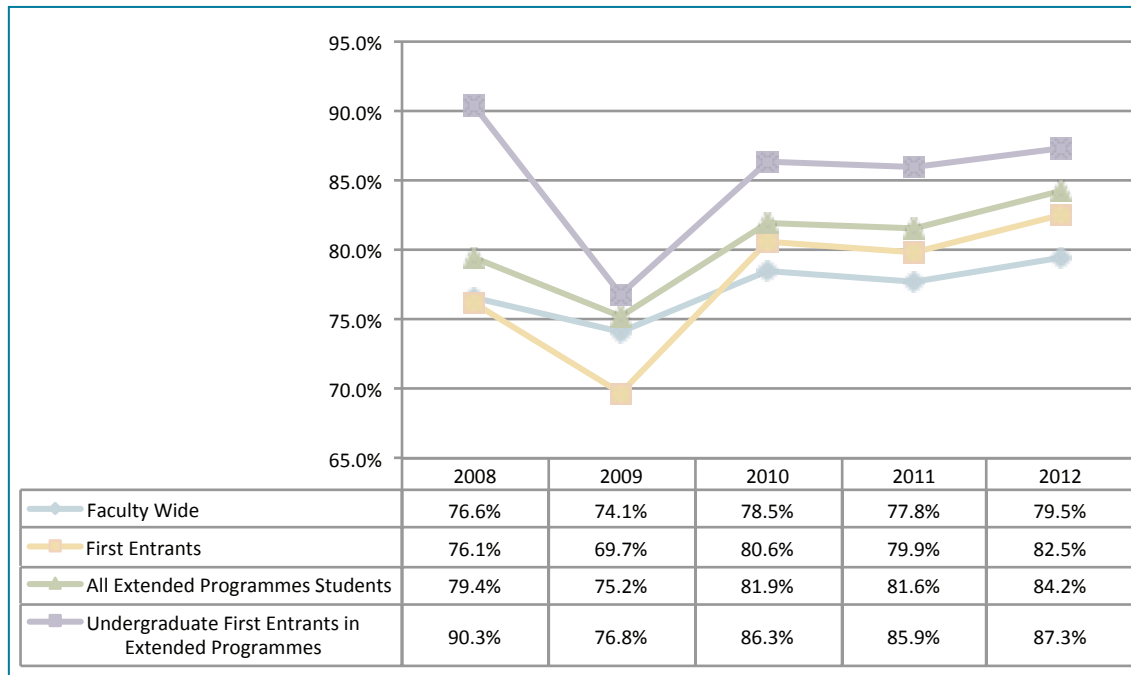
Diploma programmes appear to constitute suitable vehicles for extended programmes, as reflected in the achievement of positive results in a range of institutions. The extended programmes in the current three-year diplomas in the Faculty of Management at the University of Johannesburg (UJ) provide an example of such success.

UJ has had extensive experience with extended diploma programmes. In the Management Faculty, subject specialists and staff of the Academic Development Centre co-operate in offering extended programmes in five diplomas: Small Business Management, Human Resources Management, Management, Logistics, and Transportation Management. The collaboration has focused strongly on course and materials development, which provides fertile ground for education and subject specialists to complement each other's capabilities.

The relatively low entry requirements for diploma studies mean that many of the students who are admitted to them are underprepared for the existing mainstream curricula. Since extended curricula have been offered predominantly to students who do not meet regular admission criteria, these programmes need to accommodate very low average levels of preparedness, as well as a range of other difficulties related to students' circumstances and backgrounds. The academic problems are familiar – a severe articulation gap, difficulties with the medium of instruction for the majority of students for whom English is a second, third or sometimes fourth language, and mainstream curricula that have not adjusted to these realities – but they often take an extreme form. It has therefore been necessary for the extended programmes to make full use of the extra time they afford, in order to adopt different approaches and assumptions that match the students' actual strengths and needs.

The academic approaches adopted in the extended programmes are predominantly of the kind that depend on additional curriculum space: integrating foundational provision of various kinds into mainstream modules; identifying and developing threshold concepts; allowing students the time to master basic elements of their subjects; and explicitly targeting the main elements of the articulation gap (Shandler 2013). The effectiveness of this is illustrated in the following graph.

Figure 7: FTE success rates of different student groupings in the University of Johannesburg Management Faculty, by year



Source: Shandler 2013

This graph shows the following:

- The performance of all extended programme students was consistently higher than that of all students and of all first-time entering students in the Management Faculty's diploma programmes.
- The performance of first-time entering extended programme students is the strongest among all the groupings. This is to be expected in effective extended programmes, given the higher level of support that can be offered in the first year.
- The overall dip in performance in 2009 came in the year after the first writing of the new NSC. Some linkage is suggested by the fact that it was first-time-entering students whose performance dropped the most.

The consistency of these patterns over five years indicates that foundational provision within an extended curriculum structure can mitigate the articulation gap. Since this approach has been effective with students with a unusually low average level of preparedness, there is reason to expect that it would be as or more successful with the large numbers of better-prepared students who are failing in the current mainstream curricula and who do not have access to the advantages of an extended programme.

Commerce and Accounting at the University of Cape Town

The BCom extended curriculum programme at the University of Cape Town (UCT) has a two-decade history but has evolved substantially in recent years. It has a particular focus on Accounting. A mark of its success is that it has facilitated a major improvement in completion rates among

its students, despite their at-risk profile, and this success has carried through into postgraduate qualifications in Accounting, including the Chartered Accounting Board examinations.

The BCom extended programme has in recent years achieved remarkably high completion rates in comparison with most other extended programmes across the country. Significantly, the completion rates are competitive with, and in some cases are better than, those of mainstream BCom programmes. Table 7 provides a summary of the performance of the last three completed cohorts.

Table 7: Intake and completion rates of BCom foundation students, by cohort and year of study

	2005	2006	2007
Intake	113	108	85
Graduation within 4 years	42%	50%	56%
Cohort completion rate	75%	90%	76%
National BCom completion rate	55% (within 6 years)	58% (within 5 years)	n/a

Source: Derived from Pym 2012

There has been a marked rise in the proportion of extended programme students gaining access to the Graduate Diploma in Accounting (GDA), which has stringent entry criteria and is the gateway to the professional Board Examinations leading to registration as a Chartered Accountant. The good success rates achieved in the GDA have led to strong performance in the Board Exams, as shown in Table 8 below.

Table 8: Extended programme student performance in the Graduate Diploma of Accounting and CA Board Examinations, by cohort⁸

	2006	2007	2008	2009	2010	2011
GDA intake	3	1	24	28	42	62
GDA graduates	2 67%	1 100%	17 71%	23 82%	26 62%	26 42%
GDA graduates passing Board Exam (Part 1)	2 100%	1 100%	14 82%	22 96%	24 92%	21 81%
GDA graduates passing Board Exam (Part 2) (Final CA qualification)	- -	- -	10 59%	15 65%	n/a ²³	n/a

Source: Derived from Pym 2012

Given the well-known shortage of African Chartered Accountants in South Africa, the BCom extended programme can be said to be making a significant contribution to transformation.

²³ n/a: examinations still to be written

A characteristic of the BCom extended programme that is believed to contribute strongly to its success is that it has used the extra curriculum space of the extended programme both to enable its students to develop strong academic, personal and social foundations for advanced study, and to create flexibility in progression pathways, including innovative ways of addressing major hurdles and transitions throughout the curriculum. This approach cannot overcome key limitations of extended programmes²⁴ but nevertheless caters as far as it can for a range of strengths and needs in the students, and thus improves motivation to succeed.

In this regard, the BCom extended programme is closer to addressing the systemic curriculum problems identified in Chapter 4 than most other extended programmes, so its success supports the case for structural reform that this report seeks to make.

Science at the University of KwaZulu-Natal

BSc foundation and extended programmes at the University of KwaZulu-Natal (UKZN) and its predecessor institutions also have a long history, spanning three decades. The current UKZN BSc extended programmes are valuable to consider here particularly because of what they indicate about who the beneficiaries of curriculum reform would be. The brief analysis here is drawn from cohort studies of two different extended BSc programmes that co-exist at the university, covering the 2005-2008 intake cohorts (Kioko 2012).

The UKZN case offers a unique combination of features, including the following:

- It is a long-established research university where the great majority of the students in Science are now from previously disadvantaged groups: in 2005-2008 (the intake years used for the cohort studies) the students admitted into Science programmes were 40% African, 41% Indian, 12% white and 2% coloured, with the balance made up of non-South Africans.
- The two BSc extended programmes that have been offered simultaneously in recent years use different models and have different target groups, so provide a good basis for comparison with each other as well as with the mainstream BSc.

The two extended programmes are: (a) *the BSc4 (Augmented) Programme*, which is based on 'augmented' Science courses (which blend foundational and mainstream material), academic literacy modules and a reduced curriculum load in the earlier years of the programme; and (b) *the BSc4 (Foundation) Programme*, which is based on a year of preparatory Science and academic literacy modules. The programmes are designed for target groups with different levels of preparedness: the Augmented programme, with a higher starting level, is aimed at students who are only marginally below the Faculty's regular admission criteria, while the Foundation programme, which assumes a lower level of prior learning, targets students whose school-leaving grades are 'substantially below' the regular entry criteria.

²⁴ The contribution and limitations of this BCom extended programme, and a similar one in Engineering, were the topic of a doctoral thesis in Economics, Smith (2012).

Table 9 compares cohort performance in the two extended programmes with that of African, Indian and white mainstream BSc students admitted in the period 2005-2008.²⁵

Table 9: Intake and performance in BSc extended and mainstream programmes at UKZN: 2005-2008 intakes²⁶

	Mainstream BSc			Extended BSc programmes	
	<i>African</i>	<i>Indian</i>	<i>White</i>	<i>'Augmented'</i>	<i>'Foundation'</i>
Intake 2005-2008	1021	1270	517	576	639
% of total BSc intake	24%	30%	12%	14%	15%
Estimated final completion rate ²⁶	59%	54%	68%	43%	31%

Source: Derived from Kioko 2012

Key points from the analysis include the following:

- The two extended programmes have enabled access to be widened to include a considerable number of students from educationally disadvantaged backgrounds: over the period, this benefited more than 1200 students who would not have been admitted to the university on standard entry criteria. The extended programme intake added 52% to the regular enrolment.
- The extended programmes' contribution to graduate output in the designated groups is less substantial but nevertheless significant. In view of the relatively high risk level among extended programme students, lower completion rates are to be expected. Even so, it is estimated that the extended programmes will increase the final number of African, coloured and Indian Science graduates from the cohorts concerned by 34%.
- The differential completion rates of the two extended programmes point to at least two distinct but inter-related challenges. On one hand, since the 'Foundation' programme targets students whose school-leaving results are well below the standard admission criteria, its lower completion rate may indicate the difficulty of successfully accommodating students with relatively low school attainment. On the other hand, the model of the 'Foundation' variant itself may not be optimal in the context; in particular, the fully foundational year it is based on – which by design offers a more fundamental level of provision than the 'Augmented' programme – may be difficult to articulate with the mainstream courses that follow. Whatever the explanation, both these challenges have important implications for how SET performance may be improved across the system, and for the need for structural curriculum reform.
- Despite the contribution of the extended programmes, the overall completion rates of African, coloured and Indian Science students remain below equitable levels. Thus, while strong progress has been made with equity in access (with 83% of the intake coming from

²⁵ Coloured student enrolment is too low to be significant.

²⁶ Partly because of the different minimum times of the mainstream and extended programmes, there is considerable variation in the proportion of students who are still registered at the end of the period analysed and who may still graduate. To facilitate comparison, the 'estimated final completion rate' assumes that 80% of these students will eventually graduate.

the designated population groups), equity in output has not yet been achieved. As Kioko states (2012: 24):

This [the demographic composition of the intake] may question the current need for an access-type programme for the sciences at UKZN. What is clearly desperately needed is a means to improve the success rates of students who have already been admitted into the university through the mainstream selection criteria. Improving the success rates of these students will improve successful access into science degrees for students from previously disadvantaged backgrounds. There is arguably reasonable access at present via the mainstream route, but this is undermined by the high attrition rates of these particular groups of students.

The UKZN programmes thus both illustrate and support the argument that, while successful extended programmes have made an appreciable contribution to equity and development, the full value of structural curriculum reform will only be realised when it is applied in the mainstream and is thus available to the full range of students who will benefit from it.²⁷

Engineering at the University of Pretoria

The ENGAGE programme serving the Engineering degree at the University of Pretoria (UP) is a new extended programme, established in 2010, with a formal duration of five years. It replaced an earlier extended programme with a new approach informed by research and strong design principles. Even though only two years of data on ENGAGE are available, the programme is included among these cases because it points to the effects of sound curriculum design on addressing the articulation gap. To illustrate this, comparisons of early retention rates are made between ENGAGE, the former extended programme and the mainstream, for all students and for African students, as set out in Tables 10 and 11.

Table 10: Comparison of retention rates between the ENGAGE programme, a former extended programme and the mainstream programme in Engineering at the University of Pretoria: all population groups²⁸

	Former extended programme: cohort 2009	Main-stream: cohort 2009	ENGAGE: cohort 2010	Main-stream: cohort 2010	ENGAGE: cohort 2011	Main-stream: cohort 2011
Intake	208	847	291	793	368	691
Retention into Year 2 ²⁸	49%	76%	65%	80%	76%	87%
Retention into Year 3	44%	68%	59%	73%	n/a	n/a

Source: Derived from Grayson 2012: 18

²⁷ For in-depth accounts of these and other extended programmes at UKZN, see Dhunpath and Vithal (2013).

²⁸ The retention figures represent only students who remained in an Engineering programme. Some others transferred to different programmes, so the total retention rates are higher.

Table 11: Comparison of retention rates between the ENGAGE programme, a former extended programme and the mainstream programme in Engineering at the University of Pretoria: African students

	Former extended programme: cohort 2009	Main-stream: cohort 2009	ENGAGE: cohort 2010	Main-stream: cohort 2010	ENGAGE: cohort 2011	Main-stream: cohort 2011
Intake	104	204	102	202	155	167
Retention into Year 2	53%	70%	78%	73%	79%	84%
Retention into Year 3	47%	59%	71%	63%	n/a	n/a

Source: Derived from Grayson 2012:19

Key points about ENGAGE performance include the following:

- While possible differences between the intake profiles are not controlled for, ENGAGE shows greater capacity to close the articulation gap than the former extended programme: retention rates at the end of Year 1 – the critical time for addressing the articulation gap – are markedly higher, especially for African students. The same applies to the retention rate at the end of Year 2, though data for only one cohort are available.
- Formal qualitative comparison between the two extended programmes has not been undertaken, but the ENGAGE staff attribute much of the strength of the programme to design that is informed by educational theory and an internationally recognised approach to initial Engineering education (Grayson 2012).
- Despite a significant increase in intake, ENGAGE's retention rate into Year 2 increased somewhat more than that of the mainstream from the 2010 to the 2011 cohort, most likely because of learning from experience. More important, however, is the argument that the introduction of ENGAGE has facilitated the improvement of the mainstream first-year retention rate as well, because each of the two programmes is better able to meet its students' needs in the early stage of their studies, and hence is better able to help them realise their potential. The data support this view: ENGAGE's share of the enrolment, and the mainstream and ENGAGE one-year retention rates, are all growing.
- While the retention rates in ENGAGE and the mainstream are not directly comparable because of different forms of provision, ENGAGE's performance in comparison with that in the mainstream is noteworthy, given the significantly different risk profiles of the two student groups. ENGAGE has a large enrolment by extended programme standards and is thus playing an increasingly important role in the faculty.
- ENGAGE has had particularly noteworthy success with African students. The retention rates have been very close to those of the mainstream African students (who would have had a higher average level of preparedness) and in the 2010 cohort exceeded them. This degree of success, combined with ENGAGE's large share of the total African enrolment (virtually reaching parity in 2011), indicates that the extended programme is making a major contribution to equity of access and performance in Engineering at UP, and appears to be on track towards extending that contribution up to graduation.

In short, ENGAGE is demonstrating the value of a well-designed alternative curriculum structure – explicitly aimed at addressing the articulation gap and other systemic obstacles – in an intellectually demanding and strategically critical field.

5.5 Conclusions

The argument that structural faults such as the articulation gap can be effectively addressed by structural responses is supported by the graduation of many thousands of students who have entered higher education by means of foundational or extended programmes. The great majority of these students would not have qualified for admission to the corresponding mainstream curriculum, and according to school-leaving grades and entry-level assessments, were underprepared for conventional higher education programmes. Given that, at the same time, large numbers of better prepared students have not been successful, it could be predicted that the extended programme students would have had a very low probability of completing their programmes. A significant variable accounting for their success thus seems to be the provision of additional, productive curriculum space. Reducing the articulation gap reduces underpreparedness and improves students' chances of succeeding.

However, the problems inherent in the current extended programme model, arising primarily from its minority and marginalised status, impose intractable limitations on its success. It is interesting that early writing about foundational provision, going back to the 1980s, indicates that the model was not seen as a permanent solution but rather as paving the way for mainstream curriculum reform.

In summary, the available evidence suggests that structural curriculum reform that takes account of students' educational backgrounds can positively influence student performance. Because of current constraints, however, the educational advantages underlying extended curriculum provision will not be fully realised until they are fully integrated into an enabling curriculum structure and are available to the large numbers of students who are talented but not coping with traditional curricula. This report thus argues that it is time for structural curriculum reform to be applied systemically.

6. What can be done in higher education? The case for structural curriculum reform

Chapter overview

With curriculum structure having been identified as a central systemic issue, this chapter focuses specifically on the argument for structural curriculum reform – with particular reference to the parameters of undergraduate degree and diploma programmes – as an intervention that is key to improving graduate output and outcomes, and that the higher education sector collectively has the power to put in place. After a brief review and analysis of the central features of curriculum reform needed to substantially increase the effectiveness of the teaching and learning process, it is concluded that providing additional curriculum space is essential for enabling the majority of the student body to succeed in mastering their core curricula, and for enhancing the quality and relevance of South Africa's main undergraduate degrees and diplomas. In current circumstances, creating the additional curriculum space needed depends on lengthening the duration of most degree and diploma programmes by a year.

In substantiating the argument and considering the implications of the proposed reform, the chapter assesses who would benefit from it, and discusses its significance for addressing inequalities and the pressures for growth in higher education. It also considers alternative options, issues of academic standards, institutional autonomy, and international precedents.

Recognising the critical matter of the diversity of the student body in terms of educational, socio-economic and linguistic background, the chapter argues that flexibility is also an essential element of an effective new curriculum structure – flexibility in starting points and progression that will enable students to follow curriculum pathways that accord with their level of preparedness and personal circumstances, and enable them to maximise their chances of succeeding. This means that, while additional time must be the new norm, provision must be made for recognition of prior learning and shorter routes to completion for those students who can successfully manage this.

The overall conclusion is that changing the undergraduate curriculum structure in ways that suit the learning needs of the majority of the intake, while incorporating sufficient flexibility to accommodate the full range of the student body and ensuring exit standards and outcomes of good quality, is a necessary condition for improving substantially on the status quo.

6.1 Introduction

This chapter builds on the case set out in this report thus far, which has been based on the following main points:

- the importance of substantially improving the output of well-educated graduates, to meet the pressing needs of development and equity;
- the severe shortcomings in the current performance of the higher education sector, in terms of overall graduate output and equity;
- identification and analysis of the obstacles to substantial improvement of higher education performance, drawing the conclusion that the key constraints are systemic and that, for both pragmatic and principled reasons, the higher education sector has an obligation to act decisively in areas within its control – particularly curriculum structure, as the framework for the whole teaching and learning process – in order to facilitate successful learning across the full range of the student body; and
- an account of the extended curriculum programme initiative as an example of a significant though limited curricular intervention designed to address a key systemic fault, the secondary-higher education articulation gap.

6.2 Curriculum structure as a fundamental element of systemic reform

Evidence of the systemic nature of the main obstacles to realising the potential of South Africa's student intake has been set out in preceding chapters. Systemic obstacles occur in structural features such as the curriculum framework and other fundamental elements of the educational process. It follows that systemic reform, rather than marginal changes, is central to substantially improving graduate outcomes and output.

Among the systemic obstacles, this investigation has identified South Africa's current undergraduate degree and diploma structures as the immediate priority for reform. The reasons are as follows.

The parameters of a curriculum constitute a fundamental framework for the whole teaching and learning process. The framework determines the starting point (and thus what level of student preparedness is actually needed for success), how rigid or flexible the pathways of progression through the programme are (and thus the extent to which different educational backgrounds are allowed for), and the exit level (and thus the quality of the qualification). Thus the curriculum structure exerts a powerful influence on who gains access to higher education, who succeeds in it, and what the outcomes are. This is a critical consideration in the South African context.

A curriculum structure can be either enabling or constraining in relation to key goals. Given South Africa's inequalities and development needs, it is essential that the curriculum structure should as far as possible enable students' underlying potential to be realised, always provided that the quality of the qualification is maintained.

However, as the performance patterns show, systemic obstacles are standing in the way of realising potential. Evidence that the curriculum structure is at the centre of these obstacles comes

from practice as well as theory, particularly the three decades of experience with foundational provision and extended curriculum programmes discussed in Chapter 5.

Before considering the shortcomings of the current structure, it is important to note the following. The design of a curriculum structure is very seldom done on a blank slate, but rather develops irregularly over time, building on and making (usually marginal) adjustments to embedded parameters. The longstanding nature of curriculum structures of very different types, such as the American and British examples, indicates their resilience. The disadvantage of this is that the structures often lag behind changes in key factors affecting the process and environment of education.

The South African curriculum structure can be seen as a classic case of this. As noted earlier, South Africa's current higher education curriculum structures were adopted almost a century ago. Despite major changes in the size and profile of the student intake, and in social and workplace conditions, the fundamentals of the South African curriculum structure have remained largely the same. This lack of responsiveness, together with the evidence of systemic faults, justifies reviewing the validity of the structure in relation to contemporary needs.

6.3 Critical shortcomings of the current curriculum structure: The need for additional curriculum time for the majority of the student intake

Analysis of the shortcomings of the curriculum structure in this investigation has led to the conclusion that the structural obstacles to improving student learning and graduate output cannot be addressed effectively without increasing the normal duration of the core undergraduate degrees and diplomas. Key obstacles and their relationship with programme duration are outlined below.

The articulation gap between secondary and higher education

The origins, nature and significance of the secondary-tertiary articulation gap in South Africa have been outlined in Section 4.4 above. This section elaborates on the implications of the gap for structural reform, with particular reference to the significance of the assumptions that underlie curricula.

By their nature, higher education curricula are based on assumptions about what entering students know and can do. These assumptions can lose validity over time owing to, for example, changes in the student intake, but often remain embedded for a range of reasons. The assumptions are about knowledge (for example, Mathematics 1 may assume that entering students have a sound knowledge of calculus), academic skills and literacies (for example, a traditional BA curriculum is likely to assume that entering students are able to write a comparative academic essay), and also wider 'social capital' (for example, a BCom is likely to assume familiarity with basic financial systems such as banking). At tertiary level, assumptions have to be made, but for students for whom they are not appropriate, they are a major obstacle to learning, hindering the development of the academic foundations necessary for successful tertiary study.

While the importance of curriculum assumptions does not apply exclusively at entry level, it is manifested most clearly in the secondary-tertiary articulation gap. The gap has widened in recent

decades, not only because of some decline in the average level of student preparedness but also because, despite the major contextual changes that have occurred, higher education has retained the traditional curriculum assumptions which have been in place in South Africa for many decades and which were based on a much smaller, largely homogeneous and relatively privileged student intake.

Given the poor prospects of the secondary sector producing enough well-prepared candidates for higher education, responsibility for addressing the articulation gap falls mainly to the universities, for the pragmatic and principled reasons cited earlier. The question, then, is how best higher education institutions can deal with this challenge.

As longstanding experience in South Africa with foundational and extended curriculum programmes has shown, increasing the normal duration of a programme – and hence the curriculum space available within it – is essential for allowing the establishment of a starting point that realistically matches the prior learning of the majority of the intake, while at the same time maintaining exit standards. The current (unrealistic) assumptions underlying undergraduate curricula have persisted for an understandable reason. If exit standards are set against international benchmarks (as they must be), and if the formal curriculum time is unrealistically restricted, it is inevitable that the assumptions that result from ‘planning back’ will themselves be unrealistic. To use the Mathematics example, there is not enough time in a three-year BSc for calculus to be rigorously taught, so knowledge of the topic has to be assumed, even though for many students it has in fact not been properly taught at school. The consequence is that these students are disadvantaged from the beginning, and are likely never to gain real mastery of key concepts that are essential for successful advanced study.

By contrast, if adequate curriculum time is provided for the students to establish the right foundations – particularly in fundamental areas such as concept development, relevant academic literacies and effective approaches to learning – they show themselves as the top achievers that they essentially are. Experience with extended programmes has demonstrated this over a long period. It should be stressed that developing such foundations in higher education is quite different from re-doing school work. The topics covered may be the same, but the higher education approach is forward-looking and intellectually demanding in a different way. The same principle applies as when a subject – say a foreign language or computer science – is taught for the first time, *ab initio*, at university level.

In summary, providing additional curriculum space, by means of extending the standard duration of programmes, is an essential condition for enabling the majority of students to bridge the articulation gap.

Transitions within the curriculum

As outlined in Chapter 4, apart from the entry-level articulation gap, curriculum analyses undertaken for this investigation (see Chapter 7) have highlighted the presence of key transitions within curricula that affect progression, particularly for students from disadvantaged educational and socio-economic backgrounds. For example, the Engineering degree curriculum has a number

of significant transitions in the kind of knowledge and competencies that students have to deal with, such as the transition from basic science and mathematics to engineering sciences, and from the latter to engineering design, research and project management. In the BCom, many students are tripped up by an absence of contextual knowledge, such as of the financial system, that the curriculum assumes is in place.

All these cases are examples, in one form or another, of assumptions about prior learning that are not valid for significant groups of students, probably the majority. The only effective way of correcting this is to put in place forms of developmental provision at appropriate stages in the curriculum. The reasons that such provision is not in place are, first, that existing curricula take the background knowledge and experience for granted, and second, that there is no room in the existing curriculum for addressing this key matter.

There are also other, perhaps more subtle transitions that can and should occur in students' progression through the curriculum. An example is a rapid rise in intellectual maturity that academic staff members often observe in students in the final year (currently the fourth year) of professional programmes. This maturation, which manifests itself particularly in self-confidence, synthetic ability and independence in learning, appears to be a function of physiological maturation, a sense of 'settling down' in the institutional environment, simple passage of time, and (critically) the provision of learning activities and challenges designed to encourage rapid personal growth and professionalisation. Again, there is insufficient curriculum time in most current undergraduate programmes for personal growth of this kind, which is much needed by the majority of students as a graduate attribute or a preparation for postgraduate study.

The transitions outlined here can clearly not be effectively addressed by means of marginal interventions or entry-level foundational provision, but call for coherent curriculum development. **The second purpose of extending the duration of programmes is therefore to enable the curriculum as a whole to be designed in ways that are responsive to the diversity of the intake and the complexity of the personal growth process.**

The curriculum exemplars commissioned for the investigation which are discussed in Chapter 7 illustrate the principles and possibilities of such design in five qualification types.

The need for curriculum enhancement

The motivation for additional curriculum time as the norm in South Africa has thus far focused on facilitating learning in existing core curricula. This is critical for the interlinked goals of improving graduate output and equity of outcomes. However, the need to improve the quality of our qualifications and graduates is equally important. An enabling curriculum structure, facilitated by the provision of additional curriculum time and space, is a necessary condition for meeting this need as well, for the reasons outlined below.

It should be noted that the term 'enhancement' is used here to refer to provision that improves or enriches learning (as opposed to inserting additional conventional content) and that goes beyond

what is offered in current programmes. Using this meaning, the investigation has focused on the following interlinked forms of curriculum enhancement:

- *Developmental provision that supports core curriculum learning in fundamental ways, such as the development of relevant academic literacies, including language-related, quantitative and information literacies.* In the South African context such provision can be seen as essential for addressing educational inequalities. Because of this, it should be incorporated as an integral element of the standard curriculum, available to all students who need it, rather than a peripheral or optional offering. Since it is the majority that would need it, the aim is that such provision should in future become the norm, and in fact be recognised as part of the core curriculum.
- *The development of knowledge and competencies that are closely related to core curriculum goals but are traditionally not seen as a part of core disciplinary knowledge.* An example is the acquisition of additional languages for students in Health Sciences or Law, where communication with people from different linguistic backgrounds is a professional necessity. Again, whether learning of this kind should be seen as essential or just desirable is at present a matter of opinion, depending on what is seen as the 'irreducible core' of a curriculum. It is clear from international trends, however, that increasing the breadth of student learning is widely regarded as necessary for effectiveness in the contemporary world.
- *The development of graduate attributes that are not linked to core disciplinary learning but are believed to be important as life skills, a foundation for critical citizenship, or an element of the general quality of 'graduateness'.* The international 'Graduates for the Twenty-First Century' movement attests to an increasing global focus on such attributes. In South Africa, there is strong interest in the concept of social responsiveness and how experience with it can be included in educational programmes, to foster cultural sensitivity and civic engagement. The Task Team has noted recent initiatives in this area at some South African universities, and recommends that all institutions should take the opportunity afforded by curriculum reform to introduce such initiatives in their programmes.
- *Laying foundations for postgraduate study.* The growing importance of specialised high-level skills, as developed through postgraduate degrees, is increasingly recognised in South Africa, as evidenced in the major investments being made in Master's and especially doctoral education by the Department of Science and Technology (DST) and other national agencies. However, in the absence of effective means of strengthening the pipeline to advanced study through undergraduate education, the existing shortage of well-prepared candidates for postgraduate programmes will increase. There are two key means of strengthening the pipeline. The first is to ensure substantial improvement in performance in existing core curricula, quantitatively and qualitatively, especially in the currently under-represented student groups, as the proposals in this report envisage. The second is to enhance curricula in order to strengthen the development of academic competencies and attitudes that underpin advanced study and critical thinking, through, for example, integrating basic research approaches and an inquiry orientation into undergraduate programmes. There is now an extensive international literature on the latter topic, reflecting its significance.

Regrettably, however, the growing recognition of the value of all these forms of provision in South Africa is most often thwarted by the lack of curriculum space to introduce them. In an environment of such widespread failure, the tendency is for all available time to be devoted to teaching and learning the conventional core curriculum, with the consequence that enhancement – even of the kind that might in fact be essential to disciplinary learning – is put aside as an unattainable luxury, or, at best, given only marginal or symbolic status. Alternatively, difficult decisions have to be made about what to omit from the existing curriculum to make way for substantial enhancement activities, risking unintended consequences for core knowledge development.

It follows, then, that the provision of additional curriculum time as the norm in mainstream undergraduate curricula is an essential condition for advancing curriculum enhancement in any of its forms.

6.4 The importance of a flexible curriculum structure for addressing diversity of background

The diversity of educational and socio-economic background that characterises the student intake in South Africa, with its roots in deep inequalities, is well known to all involved, and is clearly manifested in the performance patterns. A key principle underlying the proposals in this report is that the challenge of this kind of diversity must be fully recognised and decisively responded to if the potential of the full range of the student body is to be realised. In terms of curriculum, a unitary or one-size-fits-all structure cannot be effective in achieving this. For example, the validity of the assumptions on which curricula are based differs between sections of the student body, depending on their preparedness and backgrounds. Particularly in the early stages of a higher education programme, insisting on a rigid, uniform curriculum structure for all students will inevitably disadvantage those for whom the assumptions are not valid.

Flexibility must therefore be an essential element of the curriculum structure in South Africa. As argued earlier, the first responsibility is to serve the interests of the majority of the intake, hence the need for a new norm. However, providing for diversity requires that this norm should be at the centre of a flexible structure that allows as far as possible for different levels of preparedness and rates of progression. Thus, for example, the curriculum structure should allow for students who are able to complete a programme successfully in a shorter time than the norm, to do so. In practice, flexibility of the kind needed consists primarily in allowing for differential entry points and routes of progression through the programme, provided always that the exit standards and outcomes are constant for all.

South African higher education curricula have historically had a modular structure of courses and units, with varying levels of cohesion. Modularity facilitates flexibility in curriculum design, so in that respect South African curricula lend themselves to adaptation for different purposes and levels of preparedness. The design challenge therefore is, first, to use the proposed new norm to develop core programmes that are appropriately demanding, coherent and aligned with the prior learning of the majority of the student body, and, second, to use modularity in innovative ways to create structural flexibility that accommodates the diversity of the intake as a whole.

Detailed proposals for a flexible structure are made in Chapter 7.

6.5 The scope of the challenge: What proportion of the student body would benefit from a new curriculum norm?

The performance patterns provide a strong indication of the proportion of the present student intake that would benefit from structural curriculum reform. There are two broad categories of student to be considered.

- First, a new, lengthened curriculum structure would clearly benefit all students who are currently being academically excluded or who are dropping out for learning-related reasons. Large numbers of these students have potential but are victims of systemic faults, so a curriculum designed to meet their learning needs would be expected to put many on to a successful path. The sector-wide information currently available is not able to accurately identify the reasons for 'voluntary' dropout, but data such as course success rates and institutional exclusion patterns indicate that poor academic performance affects very large numbers of students, especially in SET programmes.

The figures indicate that some 55% of all entering students, including about 45% of contact students, never graduate. Therefore, even if UNISA is excluded as a special case, it is estimated that the success of as many as 40% of the current intake (excluding only those whose reasons for dropping out have nothing to do with academic performance) is dependent on curriculum reform.

- Second, a lengthened curriculum structure would at worst not hinder the mainstream students who do not graduate in regulation time for reasons related to academic performance. **The figures show that, excluding UNISA, in the main degree and diploma programmes only 27% of all students, including 20% of African students and 24% of coloured students, graduate in regulation time.** A substantial proportion of the balance (including, of course, those mentioned above who do not graduate at all) would fall into this category and not be hindered by the new structure.

The figures therefore indicate that a majority of the contact student intake, and a greater majority of the African and coloured intake, would not be disadvantaged by an extended curriculum. On the contrary, for many the quality of their learning is likely to be significantly enhanced. While national data are not available, there is widespread concern that many of the students who eventually graduate are only 'scraping through', with a preponderance of marginal passes and initial fails in their academic records. As argued earlier, much of this can be attributed to invalid curriculum assumptions, which militate against students' developing sound academic foundations and later mastery of their discipline. At least for the large numbers of students who are taking additional years to graduate, it is educationally wise to replace time spent on failing courses with time constructively spent on foundational learning that will foster quality and success.

In summary, the data indicate that the majority of the current intake of contact students would stand to benefit from a new curriculum structure of the kind envisaged. The patterns indicate that, for up to 40%, this may offer the only realistic opportunity for success, as opposed to an overwhelming statistical probability of failure. For another substantial proportion, i.e. students who take additional years to graduate for academic reasons (estimated as 20%-25% of the intake),

effective extended provision would be most unlikely to increase total study time, and would be far more likely to improve the quality of their learning. The proportions are higher for African and coloured students.

6.6 The relationship between curriculum reform and growth in higher education

The very large number of youth who are not in employment, education or training has understandably generated extra pressure to expand enrolment in post-school education and training, with a view to creating productive opportunities for employment or self-employment. This is one of the drivers of the vision set out in the Green Paper (DHET 2012a). However, as argued in Chapter 3, access without success is a hollow achievement, and will not alleviate the social and economic problems that the policy aims to solve. What is needed is successful outcomes, and it is critical for all of the post-school sectors to rise to this challenge. For higher education, the initial growth goal must focus on output – that is, to substantially improve graduate production in terms of numbers, quality and mix.

The curriculum reform proposed here is intended to make a major contribution to achieving this goal, through providing a structural foundation for an effective and efficient higher education system that is aligned with South Africa's realities. This would not only benefit the majority of the current student body, as outlined above, but also establish a basis for responsible growth in the system. The latter would be facilitated in two key ways. First, greater efficiency in throughput can free up resources for productive growth and better distribution of opportunities. Second, greater effectiveness in the educational process leads to a higher probability of completion among the additional students admitted. This is key to the goal of widening successful participation.

Approaches to improving graduate output other than introducing the proposed flexible curriculum also need to be considered. The main structural alternative to curriculum reform is to retain the current structures and increase the student intake substantially. It can be shown, however, that this would almost certainly lead to lower success and completion rates for the following reasons:

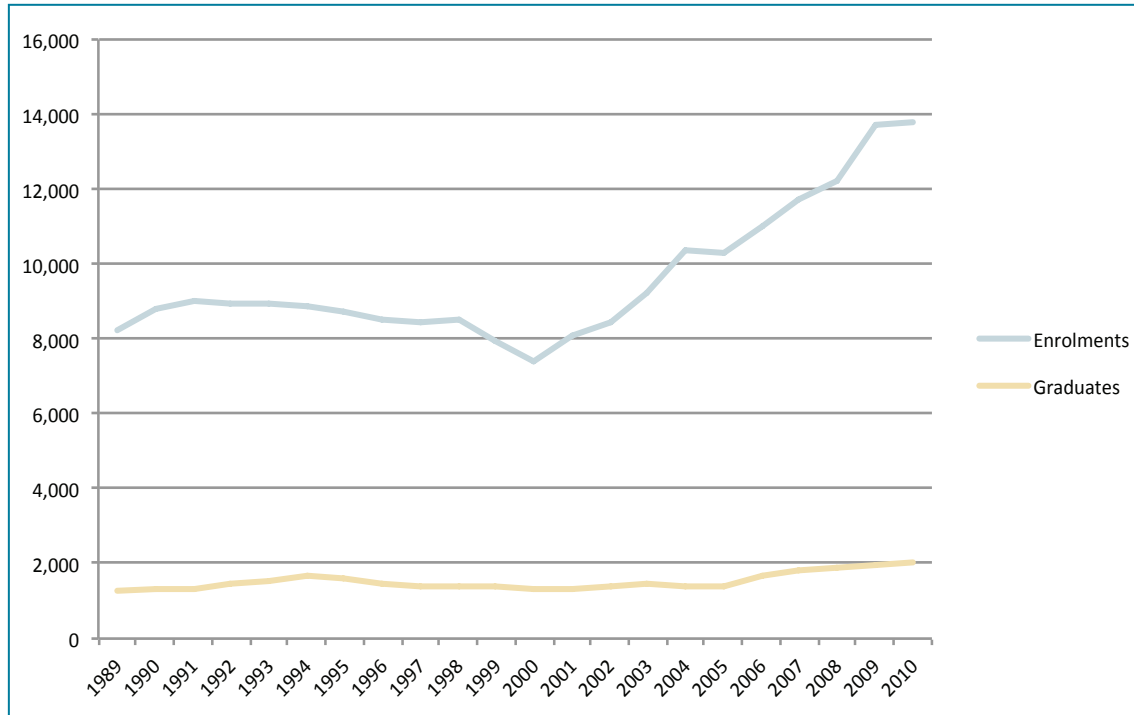
- Enrolment growth would come predominantly from students who are less prepared for existing forms of higher education than the current intake. This would mean that the average level of underpreparedness in the intake would increase.
- The total enrolment in any given year would rise sharply, not only because of the greater intake but also because of higher rates of course repetition.
- There would consequently be much greater pressure on staffing, equipment and infrastructure, resulting in dilution of the resources needed for improving student learning (see Chapter 8 for details).

Analysis (Scott and Hendry 2006; q.v. Chapter 8) has shown that, if performance patterns are not significantly improved, expanding the intake will be a highly inefficient way of producing additional graduates, involving increasing under-utilisation of talent and resources. Such conditions will also be likely to lead to loss of quality of outcomes.

The effects of enrolment growth without improvement in the effectiveness of the educational process are strikingly depicted in the following graph produced by Lawless (2012). It shows a

growing gulf between Engineering degree enrolment and graduate numbers over two decades, with significant enrolment growth producing little improvement in graduate output.

Figure 8: Undergraduate university Engineering enrolments vs graduation: 1989-2010



Source: redrawn from Lawless (2012)

There is a similar pattern in the case of Engineering diplomas over the same period. Whatever the reasons for the performance patterns, they demonstrate a poor return on investment and low utilisation of human and material resources.

This analysis reinforces the conclusion that successful growth in higher education depends on substantially improving the performance patterns, and that extending the formal time of undergraduate programmes for the majority of students is a necessary condition for achieving this.

The cost implications of the different approaches to increasing graduate output are analysed in Chapter 8.

6.7 Evidence from extended curriculum programmes

The experience of extended curriculum programmes that has been gained in South Africa is a key element of the case for structural curriculum reform. The successes and limitations of this intervention have been outlined in Chapter 5.

6.8 Addressing inequalities

The overarching benefit of a new structural norm for undergraduate curricula is that it would be a decisive step towards ‘normalising’ the South African higher education system, in that it would ensure sound articulation between higher education curricula and the upper echelon of school-leavers from all population groups. This would equally benefit the many mature learners for whom the advantages of life experience are often counter-balanced by inadequate schooling and years of absence from formal study. Changing the curriculum structure would thus for the first time align undergraduate education with the realities facing the large majority of students, in the interests of development and of equity of access and outcomes.

This leads to a related and equally important benefit for many students. Developmental programmes designed to enable students to realise their potential – in the form of academic development and extended programmes – have always been constrained by the reality or threat of stigma attaching to initiatives seen as being intended for a disadvantaged minority in the institution. Moving to a standard curriculum structure that is designed for, and followed by, the majority is a key way of allowing talented students to develop academically without such stigma and the identity problems it brings. This aspect of the normalisation of the system would address key affective issues that interfere with learning, as discussed in Chapter 2.

A further advantage for students is that a new and more flexible curriculum structure, designed to address student diversity and inequalities, would also mitigate the effects of institutional inequalities. This would be the case because a high proportion of the students who would benefit from the new, lengthened programmes will be in under-resourced institutions that struggle to enable large numbers of underprepared students to achieve a qualification of high quality within the confines of the current curriculum structure. All these students would be able to follow the new curriculum norm (as opposed to the current situation where extended programmes can be offered to only a very limited proportion of the intake) and thus have a considerably higher probability of succeeding and improving the quality of their qualification. In effect, resources would be re-directed from unproductive uses, such as funding the fail-and-repeat cycle, to where they can make a positive difference. This would contribute to realising the DHET’s vision that ‘whatever else they do, all universities in South Africa must offer a high-quality undergraduate education’ (DHET 2012a: 40).

6.9 The issue of academic standards

As argued earlier, ensuring that higher education curricula are based on realistic assumptions about students’ educational backgrounds is an essential element of improving learning. There may be concern that resultant changes in the starting point of higher education programmes will harm academic standards. However, the reverse is more likely to be true. A mismatch between student preparedness and curriculum assumptions impedes learning, so, especially in the many classes where the majority are underprepared, there is either a high failure rate or downward pressure on standards, or both. This can be the case in individual courses and in a programme as a whole. For example, where the academic level of regular first-year courses is lowered in a well-intentioned effort to accommodate underpreparedness, it becomes virtually impossible to

attain traditional exit standards through a regulation three-year curriculum. What can then happen is the replacement of more demanding courses with less demanding ones, and an intentional or unwitting change in programme outcomes.

This situation will not occur if there is curriculum space both to meet students' learning needs when they enter higher education and to reach desired outcomes. It follows that a flexible curriculum structure can also be a means of providing for institutional diversity without detrimentally widening differentials in exit standards.

There can also be concerns about the starting point itself – that is, the knowledge and academic competencies that students are expected to have when they enter a higher education programme.²⁹ A common objection to differential entry levels in the academic community is that they go against an internationally uniform higher education entry level, and consequently reduce standards. This view is not well-founded, however. Generally speaking, higher education begins where secondary education leaves off. Since secondary systems vary considerably in exit level, there is no universal higher education entry level. For example, the entry level in Botswana is two years below that of Zimbabwe (where schools go up to A-level), which itself is a year ahead of South Africa. Moreover, even though they are part of the same country, Scotland's entry level is a year behind England's, since Scottish schools do not do A-level.

The import of this is that South Africa can and should determine the parameters of its curricula in accordance with its own needs and realities, and not be bound by a rigid inherited structure that has become counter-productive to developing the country's talent. There is no question of lowering academic exit standards and outcomes, which are subject to quality assurance processes under the auspices of national bodies such as the CHE and specific professional councils. However, an enabling curriculum structure is an essential element of ensuring the achievement of good academic standards without failing large numbers of talented students in the process.

Accepting well-defined differential entry levels in South Africa, along the lines envisaged in this report, would not disadvantage well-prepared students and would boost the chances of those who are negatively affected by educational inequality. Thus it seems reasonable to accept entry-level flexibility as a means of providing educational opportunity more equitably in South Africa, particularly since it is the majority of students who are disadvantaged by the status quo.

6.10 Relationship to institutional autonomy

The focus of the proposals in this report is on creating an enabling structure for the development of curricula that meet South Africa's contemporary needs, rather than on curriculum content or orientation. The reason for this is not only that an appropriate structure is a pre-condition for effective curriculum development, as argued earlier, but also that curriculum development

²⁹ These expectations constitute the assumptions about knowledge – tacit as well as explicit – and academic skills on which a curriculum is based. Formal entry qualifications, such as level of performance in school-leaving examinations, are intended to ensure that entering students have the expected knowledge and skills. However, the wide range of pre-entry performance allowed by standard entry criteria, as well as periodic changes in the standards of school-leaving examinations, commonly results in a substantial gap between higher education expectations and the actual knowledge and competency levels of many entering students, i.e. the articulation gap.

is the responsibility of the institutions. In view of the importance attached to diversification of the higher education sector, an appropriate curriculum structure should have the flexibility to enable individual institutions to design their programmes in ways that accord with their missions, resources, niches and student profiles.

However, the parameters within which institutions design curricula are set by the state. Recommendations on how the implementation of a flexible curriculum structure may be regulated are included in Chapter 9.

6.11 The issue of the Honours degree

A suggestion has been made from time to time that a four-year structure for core Bachelor's degrees should be established by simply incorporating the Honours year. The Honours degree as a separate qualification has for some time been seen by various interested parties as problematic, owing to its ambivalent positioning between undergraduate and postgraduate education. Thus the idea appears attractive as a means of rationalising the qualifications framework without any significant changes to current undergraduate curricula.

However, the effect of creating a four-year degree in this way on the main challenges identified in this report can be adduced from the performance patterns:

- First, incorporating Honours would not respond productively to the educational diversity of the student intake and the low success rates arising from the articulation gap. Rather, given that only a minority of Bachelor's graduates are currently deemed able to undertake Honours, expanding enrolment at the latter level would result in considerably higher non-completion rates or reduced academic standards, or both.
- It would also allow no space for enhancing and modernising curricula. Adding content within an even tighter structure would inevitably further 'jam' the curriculum and increase failure rates.

The incorporation of the Honours year is thus not compatible with meeting the key challenges. However, the issue of the Honours degree remains an important one for future consideration.

6.12 Precedents

The Task Team has not identified international models that are directly comparable with the proposals in this report. In developed countries, strategies for addressing educational disadvantage are on the periphery of the system, directed at a minority of the student intake, in contrast with what needs to be done in South Africa. What is commonly regarded as 'remedial' education in these systems targets 'non-traditional' students, for example in the form of 'minority' or 'multi-cultural' programmes in universities or pre-college provision in community colleges. In many developing countries, particularly in sub-Saharan Africa, the systems have been small and elite, with little or no provision outside of the traditional mainstream.

It may be noted, however, that long-accepted curriculum structures are being questioned and in some cases changed in various parts of the world. The well-known Bologna Process in Europe

(EHEA n/d), which aims *inter alia* to standardise degree structures on the basis of a three-year first degree across the region, is founded on good quality schooling; it has spurred changes in many countries but has also run into challenges, particularly on grounds of quality – that the shorter first-degree period provides too little time for in-depth learning and intellectual maturation (see for example Labi 2009). Some prestigious individual universities, notably the University of Delhi and the City University of Hong Kong, are changing from three- to four-year core degrees, though not for all the reasons that are driving curriculum reform in South Africa. In these universities, the need to accommodate talented but underprepared students is not a priority, but the main aim – strengthening graduate outcomes through curriculum enhancement – is relevant to South Africa as well. What is clearly in common is that the existing structure is found to lack the curriculum space to meet contemporary learning needs.³⁰

A development that may be of closer relevance is that Mozambique, having moved towards a three-year first degree following the Bologna system, has reverted to a four-year structure, giving precedence to its local needs. This development is, however, too recent to provide quantitative data.

6.13 In summary

The data and analysis considered in this report indicate that, in the South African context, it is not feasible to substantially improve graduate output, in terms of numbers, quality and equity, without extending the formal time of core first degrees and diplomas for the majority of the current and future intake.

The key points recapitulated below have clear implications for the need for, and design of, a new curriculum structure. In Chapter 7, they are translated into a set of design principles, and thence into specific proposals for structural curriculum reform.

- Taken together, the performance patterns provide a picture of the shortcomings of the higher education sector's capacity to successfully accommodate the majority of the student body, particularly the student groups which remain under-represented and from which most growth will necessarily come. The small and selected nature of the student intake indicates that there is no unavoidable reason why high failure rates should persist, since the body of students that gain access to higher education must collectively have high potential to succeed.
- In this context, the high attrition rates and low numbers of students graduating in regulation time, together with the fact that about one in four contact students fail or drop out in first year, are all signs that the fundamental problem is systemic rather than a result of student deficits.
- It can thus fairly be said that the current parameters of the three-year general academic degree, the three-year career-focused diploma and (in a number of instances) the four-year professional degree are not appropriate for the majority of the current intake, and will

³⁰ For an account of current curriculum innovations internationally, see Blackmore and Kandiko (2012).

be inappropriate for an even greater proportion of students if enrolments increase. It must be asked why the sector should continue to regard these structures as standard, given all the consequences this has for planning, curriculum design, teaching and funding, as well as for the students themselves.

- The performance patterns show consistently that it is the most under-represented and historically disadvantaged groups, i.e. African and coloured students, that are least well served by the current system. This has major implications for the success of efforts to widen participation and achieve equity.
- By contrast, a flexible curriculum structure based on lengthened programmes as the new norm, with provision for students who can complete in a shorter period to be able to do so, will benefit the student intake as a whole, and also provide a basis for responsible growth in access and participation.
- Extending the standard duration of programmes is also necessary for creating the curriculum space for enhancement and enrichment of a range of kinds, from provision that is effectively essential for promoting good-quality learning for many students, to allowing for the development of graduate attributes that are needed nationally, regionally and globally.
- The maturation effect of an additional planned year of undergraduate study, often observed in current professional programmes, makes a key contribution to producing well-rounded as well as academically proficient graduates.
- Through improving graduate output and quality, higher education curriculum reform will also make a major contribution to facilitating improvement in the school and FET college sectors, since it is higher education graduates that must take responsibility, as teachers, lecturers and managers, for the key national imperative of building up these sectors.
- The same can be said about the future development of higher education, since it is South African universities that have to produce the majority of the next generation of academic staff. Moreover, strengthening the pipeline through undergraduate education is essential for the growth of postgraduate studies generally, particularly the increase in the number of PhDs that is widely seen as critical for development in contemporary world conditions. It can therefore be said that a strong supply of graduates, facilitated by an enabling higher education curriculum structure, is a necessary condition for realising the vision of the Green Paper and the National Development Plan.
- Structural curriculum reform is of course not a complete response to the challenge of improving graduate output and outcomes, but it can be expected to make a positive difference in itself, as well as facilitating effective practice in other fundamental elements of the teaching and learning process. It can moreover be expected to improve the return on investment in student support and financial aid, which is discussed in Chapter 8. The other key elements in improving learning in higher education – particularly raising the status of teaching, improving the level of educational expertise across the sector, and related matters of academic and institutional culture – are well known to take a long time to realise, and in fact to be resistant to change. Adopting a more effective curriculum structure may consequently be one of the most pragmatic and achievable approaches to improving higher education performance.

- Improving the internal efficiency of higher education holds major benefits for the country's development and for the state itself. Lengthening the curriculum formally may appear to be costly but, as the figures show, many students are currently taking one or more years beyond the regulation time to complete their studies. The existing need for additional time is shown in the increase in the cumulative completion rate between year n (where n = the regulation time) and year $n+2$ in the 2006 cohort: over the two years the completion rate increased by 83% for 3-year degrees; by 36% for 4-year degrees; and by 110% for diplomas. The state is thus currently paying for widespread failure and repeating, and receiving a poor return on its investment in higher education. The issue of the affordability of a flexible curriculum structure, in comparison with other approaches to increasing graduate output, is covered in detail in Chapter 8.

In conclusion, it is evident that the status quo of the educational function of higher education has important shortcomings, and that continuing with 'business as usual' would perpetuate these, with negative consequences for the country. Changing the undergraduate curriculum structure in ways that suit the learning needs of the majority of the intake, while incorporating sufficient flexibility to accommodate the full range of the student body and ensuring exit standards and outcomes of good quality, is a key means of improving substantially on the status quo.

The Green Paper recognises the need for attention to curriculum structure. For example:

Whatever else they do, all universities in South Africa must offer a high-quality undergraduate education. This should be the first step in overcoming historical injustices inherited from apartheid and should also lay the indispensable academic foundations for students who wish to go on to postgraduate studies. Universities should be supported in offering and mainstreaming four-year undergraduate degree programmes where necessary (DHET 2012a: 40).

The rigidity of the current funding system may serve to discourage mainstream implementation of a flexible curriculum framework (such as four-year undergraduate degrees) that can cater to the diverse needs of our students (DHET 2012a: 46).

At this juncture, South Africa has the opportunity to retain an inherited system or choose to introduce a curriculum structure that is purposefully designed in accordance with the needs of the full student body and the historical and contemporary realities of the country.

The following chapter outlines design principles and broad but concrete proposals for the flexible curriculum structure that is envisaged.

7. Proposals for a flexible curriculum structure

Chapter Overview

The preceding chapters have set out a case for reform of South Africa's undergraduate curriculum parameters – specifically for an additional year as the norm for the core undergraduate programmes, within a flexible structure that allows for student diversity – as a necessary condition for improving student learning. This chapter focuses on the main outcome of the investigation, that is, a concrete proposal for a flexible curriculum structure that suits the South African context. It sets out the essential features, underlying principles and detailed parameters of the design of the new curriculum structure that have emerged from the research and analysis informing this investigation. It identifies the national policy implications, and also puts forward a set of considerations relating to curriculum design and educational processes at institutional level.

A key element of the chapter is that it reports on, and extrapolates lessons from, the development of exemplar curricula commissioned by the Task Team to test the potential application of the proposal in practice. The exemplars inform the design principles proposed as the basis for the redesign of the curriculum structure. The chapter confirms that the comprehensive investigation conducted by the Task Team has led to the conclusion that the introduction of a flexible curriculum structure for South African higher education is both an essential step and the most immediately practicable means of facilitating substantial improvement in graduate output and outcomes as well as curriculum enhancement.

7.1 Introduction

The Task Team finds that a new curriculum structure is necessary to fulfil the following three central purposes:

- to improve graduate output in the linked interests of equity and the country's development, without in any way compromising the quality of the exit standards and outcomes of qualifications;
- to enable curricula to be enhanced in the interests of better alignment with contemporary national regional and international conditions; and
- to provide effectively and fairly for the diversity of educational backgrounds that characterises the South African student intake.

On the basis of its investigation, it argues that the best strategy for improving graduate output and outcomes is to improve the internal efficiency of the educational process in higher education by establishing a curriculum structure that is effective because it is aligned with the realities of the students' prior learning.

The purposes of the new structure are elaborated on in Section 7.3.

7.2 Proposal for a new curriculum structure

To achieve the purposes listed above, the Task Team proposes the introduction of a new curriculum structure with the following three fundamental elements:

Duration. *To meet the needs of the majority of the student intake:* The formal time of all existing three-year degrees and diplomas, and existing four-year professional Bachelor's degrees that terminate at HEQSF level 8, should be increased by one year. The purpose of this is to allow for curriculum design that takes account of the realities of students' educational backgrounds by means of appropriate forms of entry-level provision and the inclusion at other stages of the curriculum of foundational provision designed to support critical transitions for which students are differentially prepared. The policy amendments needed to provide for this change are the allocation of an additional funding unit in HEMIS and an additional 120 HEQSF credits for each of the qualification types concerned.

Flexibility. *To provide effectively and fairly for diversity in preparedness:* The new curriculum structure should be flexible to enable students who can complete a programme in less than the formal time to be permitted to do so. The main mechanism for this will be that students who can demonstrate the necessary knowledge and skills, through meeting rigorous and transparent criteria, can be granted exemption for some or all of the new first-level courses.³¹

Standards. *To ensure the maintenance or improvement of the quality and standards of qualifications while meeting the twin imperatives of improving graduate output and equity of outcomes:* Curricula in the new structure should retain or improve upon existing exit standards through utilising the additional curriculum space afforded to ensure realistic starting points and progression paths and to introduce valuable forms of curriculum enhancement.

These key elements are elaborated in Section 7.4.

7.3 Principles underlying the new structure

The proposed new curriculum structure is based on the following set of principles designed to make it effective for the full student body:

Fitness for purpose: Two inter-related purposes must be taken into account.

The first purpose is to substantially improve the success and completion rates of the student body as a whole. The contribution of the curriculum structure to achieving this purpose is to make provision for additional formal curriculum time – to allow for foundational and supportive provision in various forms and at different levels – for all students who need it. The minimum expectation is that more students will successfully complete qualifications, with greater equity of outcomes.

³¹ The majority of these courses will be in the first year of the new curricula. However, as shown by the existence of critical transitions within many programmes, foundational intervention may be necessary at various points beyond the first year for addressing differential preparedness. The term 'first-level' thus refers to the academic level of the provision concerned, not its location in any particular year of study.

The second is to provide additional time for curriculum enhancement of two main kinds: activities that foster mastery of the core curriculum, and learning experiences that enrich the programme by adding breadth and contributing to the development of desirable graduate attributes.

Flexibility: To effectively accommodate diversity in educational background, the curriculum structure must be flexible rather than reflect the assumption that a single set of parameters is appropriate for all students. There should be flexibility in starting points and progression pathways to accommodate different levels of preparedness among entering students; there cannot, however, be flexibility in exit levels.

Diversity of pathways and duration: It remains necessary, particularly for planning and funding purposes, that formal time, expressed in academic years, should be specified for undergraduate qualifications. However, a longer-term goal is to lessen the emphasis on this, in order to recognise the reality that different students need different times to complete a programme, not only because of variation in preparedness but also because full-time study is beyond the economic means of increasing numbers of students (as is the case in many countries). An educational principle behind this is that achieving the required knowledge and outcomes is what matters, and that, given the inequalities in backgrounds and resources experienced in South Africa, it is inevitable that different people will take different routes and times to arrive at the same end.

Design based on the needs of the majority of students: The formal time (and the related credit values) specified for qualifications should accord with the learning needs of the majority of the student intake. In practice, as confirmed in curriculum analyses and the national performance patterns, this means increasing the formal time of the main undergraduate programmes by one year. The new norm would therefore be four years for diplomas and general Bachelor's degrees, and five years for level-8 professional Bachelor's degrees. It is intended that the additional time should enable mainstream curricula to be designed to meet the learning needs of the majority, along lines that accord with sound curriculum development principles.

The curriculum must accommodate different levels of preparedness: All students admitted to a higher education programme should be able – and as far as possible directed – to follow a curriculum route that maximises their likelihood of graduating. The underlying principle is that the exit standards, which are embodied particularly in the senior courses of the programme, must be rigorously adhered to, but students with different levels of preparedness should be able to benefit from different forms and amounts of foundational provision, in accordance with what they need as a basis for success in their studies. A key element of a flexible structure is consequently that students who can complete their studies in less than the specified formal time should be permitted to do so.

Exit levels must be maintained or bettered: Exit levels and standards should be maintained at their present level, though provision can also be made for enrichment and strengthening graduate attributes. Use should be made of international and national benchmarking to establish comparability – not uniformity – of outcomes and standards across the sector. The underlying principle is that significant differentials in exit levels will perpetuate South Africa's historical inequalities in ways that would be counter-productive economically as well as socially.

Flexibility in institutional implementation within a common adoption of the proposal:

Different institutions should be free to use the flexible structure differently, provided that this is in accordance with their students' educational needs. In some institutions, virtually all students would follow and benefit from the new curriculum norm, while in others an appreciable proportion of the intake would be able to complete their programme in a shorter time. Having curriculum duration rather than exit standards as a differentiating variable across the sector could be expected to make a major contribution to equity of outcomes and graduate quality.

Extra curriculum space to be used for augmentation, not increasing the volume of content:

Increasing formal time could be seen by some as an opportunity for Faculties to insert additional conventional content into programmes. However, this would defeat the purposes of the flexible structure, and should be prevented through the programme accreditation process and quality assurance, as well as greater institutional accountability for output and outcomes.

Curriculum enhancement must be provided for: A new structure provides a rare opportunity for enhancing the effectiveness and value of curricula. This could be done in two main ways. First, forms of 'enhancement' that are necessary for ensuring effective learning in the core curriculum should, in the new norm, no longer be regarded as marginal but become integral elements of the curriculum. An example of provision in this category is the development of academic literacies that are essential tools for learning but are under-developed in many students. Second, forms of enhancement that contribute to desirable graduate competencies and attributes – such as developing inquiry skills, learning additional languages or gaining social responsibility experience – should be included as far as practically possible. Whether such enhancements are regarded as desirable or essential in different programmes, they have been virtually impossible to include in current curricula because of shortage of time and curriculum space.

Putting student learning first: The overarching imperative that the flexible curriculum structure is intended to address is improving student learning, and consequently the quality of outcomes as well as completion rates. The test of policies, different interpretations and forms of implementation should be the extent to which they contribute to meeting this goal.

7.4 Parameters of the flexible curriculum structure – policy to create new norms

The translation of the principles for the introduction of the proposed flexible curriculum structure into concrete and actionable parameters for implementation requires policy changes at the national level, most of which are the responsibility of the DHET.

The primary role of the state in implementing the new structure would be to create an enabling policy and funding environment, particularly through the HEQSF, HEMIS and the funding framework. The key changes required are outlined below.

The subsidy units allocated to each of the programmes concerned within HEMIS should be increased by one unit, and the minimum HEQSF credits by 120. Thus general Bachelor's degrees and diplomas would be reconfigured to carry four HEMIS units and 480 HEQSF credits, and the

specified professional Bachelor's degrees five HEMIS units and 600 credits. The purpose of the increase in allocations would be to enable an appropriate new starting level to be established as the norm, up to a year below the present first-year starting level, and to allow for the strengthening of developmental and enhancement provision within the curriculum as a whole. The intention is that the programmes based on this new norm would be designed as a coherent whole, as opposed to supplementary modules simply being appended to existing curricula.

Current four-year first Bachelor's degrees – generally being professional degrees – vary considerably in their nature and performance patterns. In some cases, such as Engineering and Law, the performance patterns clearly make the same kind of case for structural reform as applies to the general Bachelor's degrees and the diplomas. These programmes terminate at level 8, the same level as the Honours degree. However, there are also four-year degrees that terminate at level 7, such as in Education and Social Work. In recognition of these differentials in exit levels, it is recommended that all four-year professional Bachelor's degrees that terminate at level 8 be allocated an additional year of formal time, but that the normal duration of current four-year degree programmes that terminate at level 7 be considered individually, in consultation with the relevant professional bodies and regulations. In reaching decisions on this matter, it is recommended that the principles underlying the curriculum proposals should be observed, particularly the principle that formal duration should be determined by the needs of the majority of the students concerned.

In all cases, the CHE and the relevant professional councils will be involved in the necessary curriculum development and accreditation in accordance with their statutory obligations and their professional relationships with the higher education sector.

7.5 Curriculum design parameters of the proposed curriculum structure – for consideration by HE institutions

In addition to the policy parameters at a national level, there are a number of considerations for the attention of higher education institutions, as they bear responsibility for curriculum development. The main considerations relate to curriculum design, and the principles outlined below are the result of an iterative process of applying a set of desired parameters to the design of concrete exemplars, and then extracting from that process the essential elements of design that are both feasible and need to be given effect in the implementation of the proposal for a flexible curriculum structure.

Development of curriculum exemplars

Recognising the importance of demonstrating how the design principles and parameters of the flexible curriculum structure could be translated into actual curricula, the CHE commissioned five small, expert working groups to develop curriculum exemplars for five qualifications based on the new structure: the Bachelor of Engineering, the Diploma in Engineering, the Bachelor of Science, the Bachelor of Commerce and the Bachelor of Arts/Bachelor of Social Science. The working groups each comprised four or five experienced academic staff with expertise, collectively, in disciplinary teaching and research, curriculum development, academic literacies, and educational research. In the case of the professionally-orientated programmes, ECSA agreed to nominate

two members of each of the Engineering groups, and SAICA was indirectly involved through the inclusion of two experienced SAICA consultants in the Commerce group.

The main purpose was to test proposed curriculum parameters in practice through:

- providing concrete examples of curricula based on the proposed flexible structure, in order to test the feasibility of the proposals, clarify options and serve as a basis for informed debate in the sector
- testing the possible advantages and constraints of the proposed curriculum structure as a means of improving graduate outcomes and output
- identifying issues and challenges requiring resolution or further research.

The working groups were given a brief that was specific in terms of the purposes and parameters of the curriculum structure but open-ended in terms of design. The brief requested each group to produce the following: (a) diagrammatic representations of one or more curricula, where possible both generic – to show the essential framework of the design – and using specific courses as examples; and (b) since diagrams cannot illustrate nuances or alternative approaches (such as the integration of disciplinary knowledge, contextual knowledge and academic literacies), a set of complementary notes and recommendations aimed at setting out the group's own design principles, explicating the design for a range of audiences, identifying issues, and providing a basis for further curriculum development by interested parties. These notes have proved to be a key element of the exemplars.

An overview of the exemplars is given in Section 7.6 and the working groups' reports are provided in full in Appendix 2. However, since they cast light on key aspects of the design parameters, reference is made to their findings in the section below that sets out the general design parameters.

Curriculum design parameters

- The new programmes should establish an appropriate starting point through *the provision of new first-level courses that effectively address the articulation gap in its various facets*. Since key impediments to student learning originate at entry level, significant changes in provision will be necessary in the first year, utilising a considerable proportion of the additional curriculum space available.

The curriculum exemplars illustrate the different forms of new first-year provision that are appropriate for different programmes, such as Humanities courses that give the same weight to critical skills and literacies as to content, and science courses that focus most strongly on basic concept development in individual disciplines. What the new first-year courses have in common is that they are founded on in-depth understanding of the nature of the articulation gap in each programme.

- The core curriculum of the new programmes must be designed to *achieve the same academic exit level and standards as the corresponding present programmes are intended to*, using relevant benchmarks. Provision can also be made for enhanced outcomes of various kinds, such as the development of specified graduate attributes or inquiry skills (by means of a capstone course, for example). However, utilising the additional curriculum space for inserting additional conventional content must be avoided, as this would act

against the primary purposes of the new structure.

The exemplar working groups were able to apply this parameter successfully. In the key matter of professional standards and accreditation, the three working groups dealing with professional programmes all included members with extensive experience of the relevant professional boards and their accreditation criteria. All three groups found no conflict between the curricula designed in accordance with the new structure and the standards of the professional bodies. It may well be that the provision for enhancement in the new structure will help to resolve some persistent difficulties in aligning faculty priorities with those of the professional bodies, but constraints on curriculum space may continue to be a factor.

- The way the curriculum is developed between these entry and exit parameters will be an institutional responsibility, in line with institutional autonomy. The goal will be to *establish new standard progression routes that meet the guidelines for sound curriculum design*, particularly in relation to the sequencing of material and a steady increase in intellectual challenge and workload, avoiding substantial step-changes. A minimal-change approach would entail most development taking place at the earlier stages of the programme. However, the increase in curriculum space would allow for innovation and creativity in modifying or re-thinking provision throughout the programme. Provision must also be made for educationally sound curriculum pathways for those students who will be permitted to follow a shorter route. Establishing flexibility in progression through the curriculum, to meet diverse needs, is a key element of effective design in the South African context.

All the working groups were able to design sound new progression pathways. However, the general formative degrees – the BA/BSocSc and the BSc – allowed fewer opportunities for innovative design because of the need for standardisation of course structure to accommodate a wide range of subject combinations. In contrast, the professionally-orientated qualifications, which are more programmatically structured, lend themselves to creative design, with a variety of curricular building blocks available.

- *Providing for completion in less than the formal time is a key element of the flexible curriculum structure.* Provision must be made for educationally sound curriculum pathways for those students who will be permitted to follow a shorter route. Changing from the existing rigid structure to another rigid one would not address the central issue of diversity in preparedness. With reference to the principles set out above, in addition to provision made at national level, institutions will need to ensure that students who can complete a programme in less than the standard time are able to do so. It is envisaged that two main mechanisms can be used for this:

Entering students who can demonstrate advanced preparedness, in individual subjects or across the curriculum, should *be exempted from first-level courses that they are deemed not to require*, up to a maximum of 120 credits. This would be in line with the broad principle of RPL (Recognition of Prior Learning). The mechanism would be to grant such students exemption for the courses concerned, so no state subsidy or tuition fees would be payable for these courses. Students could demonstrate advanced preparedness through pre-entry performance or testing or post-entry assessment in the higher education institution.

Students who demonstrate a high level of performance in courses within the curriculum may *be permitted to increase the number of courses taken per semester*, subject to continuing good performance.

The curriculum exemplars confirm that providing for completion in a shorter time is feasible, though it can present a design challenge in some programmes. The central objective is to ensure that coherent curriculum pathways are available not only for the majority, following the new norm, but also for the students who can take a shorter route. The different nature of the curriculum in the five qualification types requires different approaches, but it is believed that the models developed in the exemplars offer design guidance that may be of immediate use to a range of institutions, and that faculties will come up with innovative alternatives, geared to their own contexts, as the system develops.

- Individual institutions' missions, academic resources and student profiles will have a bearing on the ways in which the new structure can be utilised for *curriculum enhancement*. Additional provision that is essentially developmental, supporting learning, should wherever possible be integrated into the core curriculum. Enhancement intended to provide breadth or other forms of enrichment is strongly encouraged, provided always that the central purposes of curriculum reform are kept firmly in mind. A danger would lie in overloading the curriculum with new requirements, to the detriment of good quality learning.

The exemplars have focused primarily on covering the core knowledge areas of the curriculum – at a pace that is challenging but realistic for the majority of students – as well as integrating additional provision designed to support the core learning.

- At the same time, it is recommended that the opportunity for context-sensitive enrichment afforded by structural change should be taken where possible, with consideration being given to *re-orientation of existing material*. For example, given its significance in the South African context, social awareness and responsiveness can be integrated into courses where this is feasible, or introduced in innovative stand-alone ways, possibly replacing an elective module where this could be academically justified.

The importance of these forms of enhancement was fully acknowledged by the working groups, but with the caution that curriculum space for them is limited. This points to the value of integrating the development of desired graduate attributes into core provision wherever possible.

- The experience that a number of institutions have gained through mounting extended curriculum programmes may prove valuable, especially in developing new first-year provision. However, *it is not envisaged that the new programmes should simply follow the format of current extended programmes*, since the design of the latter has been constrained by the need to graft foundational courses on to rigid mainstream curricula, and have only very rarely, and in limited ways, been able to address obstacles throughout the curriculum. Even with a minimal-change approach, designing coherent new programmes should be expected to produce a significantly more effective curriculum.

This point is strongly borne out in the exemplars. A number of the working group members had experience of designing extended programmes. This was an asset, but the removal of the constraint of having to work around conventional mainstream curricula allowed for coherent design of the curricula as a whole.

7.6 Design considerations emerging from the curriculum exemplars

This section provides more detail on the process of developing exemplar curricula and a discussion of points of commonality and difference across the qualifications, as well as notes on particular challenges in each of the programmes.

A note on the process

The documentation provided to the groups included a detailed brief as well as background papers on curriculum structure and current performance in higher education in South Africa. There was a plenary workshop for members from all the groups to launch the process, whereafter the groups worked at face-to-face meetings and electronically. The groups also undertook their own research, albeit limited by the time available.

The process of the groups' work illustrated some of the challenges of curriculum design that goes beyond standard templates into questioning and re-thinking existing structures, and seeking to apply principles of effective design as a point of departure. They all accepted the vision and purposes of the flexible curriculum idea, but in all cases it took time for the groups to free their thinking from the current curricula that they were very familiar with, indicating the embeddedness of the existing structures. However, when their collective thinking was freed up, it released creativity and a rare engagement with curriculum fundamentals. The products of this approach are shown in the exemplars and especially in their accompanying text.

Some points of commonality and comparison across the exemplars

The need for reconstituting the mainstream

The groups all endorsed the necessity for structural reform to meet the needs of the majority of the current and future intakes, and the consequent need to reconceptualise what constitutes the mainstream. They saw systemic change, rather than the 'trap of tinkering', as key to avoiding a 'drift to low performance' (Meadows 2008, cited in the BEng report). They stressed the importance of 'meeting the students where they are' and ensuring that the assumptions underlying the curriculum design were valid for the realities of the student intake. The common points of departure that emerged are largely in line with, and reinforce, the findings of the investigation.

Developing theoretical and operational understanding of 'educational disadvantage' and its implications for closing the articulation gap

The groups' work collectively contributed to advancing a nuanced and operational understanding of what 'educational disadvantage' and 'underpreparedness' mean in the South African context. As discussed earlier in relation to systemic faults and the articulation gap, the meaning behind these terms is critical to accurately identifying the underlying obstacles to learning and hence putting in place interventions that produce concrete improvements, rather than well-intentioned but misdirected ones. However, as noted, the terms mean different things to different people and constituencies, with negative consequences for concerted efforts to produce improvement. The challenge is to explore the concepts in ways that facilitate analysis and informed decision-making. Accordingly, the approach taken in the exemplar project was to squarely acknowledge the kinds

of prior learning – strengths and shortcomings – usually experienced by students from different educational backgrounds; to compare this reality with what higher education programmes expect students to have learned before entering, in order to delineate the articulation gap; to recognise that the articulation gap affecting students from disadvantaged backgrounds arises predominantly from these students' lack of exposure to sound educational experiences, rather than inability to learn; and to use this understanding to determine what provision should be put in place to enable the full range of students to have a realistic opportunity to reach their potential.

The progress the groups made in understanding the key issues occurred primarily through their engaging with students' learning challenges in the context of specific programmes and disciplines. It depended mainly on two factors: the group members' strong collective and individual experience of teaching and learning in their specific domains; and access to relevant educational research, including recent innovative approaches to analysing curricula through knowledge domains. The process produced insights into the challenges of student diversity in the specific programmes concerned, and also, when considered across the programmes, into underlying, more generic challenges.

Two particular manifestations of educational disadvantage emerged from the exemplars. First, taken together, the groups' analyses of what was needed to align their curricula with the realities of the students' prior learning confirmed the multi-faceted nature of the articulation gap and that different aspects of it are highlighted in different programmes. To take one comparison as an example: the articulation gap is most strongly manifested in the BSc in the areas of subject knowledge, with particular reference to concept development as opposed to procedural knowledge in core disciplines like Mathematics, Physics and Chemistry; in contrast, in the BA/BSocSci, the most critical issue is students' capacity to engage with texts in increasingly sophisticated ways, with all that entails regarding, among other things, the deeper academic literacies, mastering specialised discourses, and productive as well as receptive language skills in domains from argument to the aesthetic. Addressing the articulation gap in these different programmes has important implications for curriculum design: the systematic, cumulative building of concepts and models as well as procedural knowledge in the BSc, by whatever means, in comparison with, for example, the spiral curriculum approach in the BA/BSocSci, centring on revisiting concepts and text-types with increasing depth and nuance.

Second, as referred to in Chapter 6, there is increasing understanding of transitions between knowledge domains that take place within curricula, and for which students are differentially prepared because of their backgrounds. Identifying such transitions is critical to widening student success because, although they can undermine student progress, they are usually so embedded that they are effectively invisible to many academic staff; and if they are recognised, it is assumed that students have the necessary knowledge and experience to cope with them. However, this assumption is not correct for large numbers of students. The exemplars all identified instances of incorrect assumptions of this kind and proposed ways of addressing them, as noted in the comments on the individual exemplars below or in the working groups' reports.

As may be clear from this discussion, effective curriculum development in the South African context calls for a systematic understanding of the strengths and weaknesses of what students

bring with them into higher education, as well as an analytical understanding of the nature of the particular curriculum, including what constitutes intellectual progression within it.

The tension between coverage of disciplinary knowledge and providing curriculum space for enhancement

Despite the additional curriculum space afforded by the new structure, the working groups encountered, in one way or another, the ongoing tension between coverage of the ‘irreducible core’ of a curriculum and the desirability of a range of enhancements. If student success is to be substantially increased, time spent on the core elements has to increase as well, since the disciplinary or professional integrity of the qualification cannot be compromised. At the same time, the growth in knowledge is increasing the danger of overloading curricula with disciplinary content to the extent that the quality of learning is undermined for most students; curriculum ‘jamming’ is well recognised as counter-productive, particularly in professional programmes. This tendency limits the possibility of enhancement.

It has thus become clear that difficult choices have to be made. At a minimum, there must be regular reviews of what constitutes the irreducible core of a curriculum. The working groups regard it as essential to incorporate developmental provision that supports the learning of core disciplinary knowledge. Such provision will vary in form by subject area (for example, from language to contextual or conceptual knowledge development) and may be needed at different levels of the curriculum, but the common factor is that it is an essential means of enabling a large proportion of the student body not only to complete their studies but also to gain genuine mastery of their fields.

The provision of enhancement relating to graduate attributes will be affected by institutional mission and context as well as on the extent to which curricula are efficiently designed (for example, to optimise the integration of developmental provision into core courses). Growth in curriculum and course design expertise, in the context of a maturing system, will facilitate continual refinement of curricula. Moreover, innovative uses of educational technology and online education may provide many new opportunities for curriculum enhancement. Nevertheless, it is likely that the tensions inherent in balancing different elements of the curriculum, and the related debate on priorities, will be a feature of the system for a long time.

The significance of pedagogical change as a complement to structural reform

The new curriculum structure is intended to create a framework that will in itself address key structural obstacles to student learning, but it will also provide a basis for the ongoing development of teaching approaches that are appropriate for the nature and diversity of the student body. The relationship between curriculum structure and pedagogy is an iterative one, in that an enabling framework allows for and encourages effective teaching, which in turn plays a key role in optimising the effectiveness of the framework.

Moreover, as the new structure becomes established, the emphasis of educational development work is likely to shift from curriculum and course design to teaching development in its varied facets, from improving the effectiveness of classroom practices and the use of technology to collaborative approaches to integrating learning by means of vehicles like capstone courses.

All the exemplar working groups thus stressed the importance of recognising pedagogical development as a complement to structural curriculum reform, and of taking steps to raise its profile. This highlights the need to extend opportunities for professional development for academic staff in relation to their educational role, as part of the wider agenda for improving student learning. The role of professional development in the process of implementing the new structure is discussed in Chapter 9.

The specific exemplars highlighted

The following observations give a flavour of what emerged from the work on the curriculum exemplars.

The Engineering degree: Among the features of the work on the Engineering degree was the identification of, and approach to addressing, key transitions in the curriculum for which students from different backgrounds are differentially prepared. In common with all other programmes, the secondary-tertiary articulation gap is important but there are others, occurring at various points in the curriculum, that are arguably as critical, and that trip up many talented students. The key transitions include: from basic sciences to engineering sciences, to complex problem-solving, to engineering design, to research and to project management. The working group, building on research in the field, recognised that the existing Engineering curricula take it for granted that the students have the background knowledge and experiences necessary to successfully negotiate these transitions. Yet this is not the case for an increasing proportion of the student intake. The traditional assumptions are thus not valid. The only way to address this matter is to put developmental provision in place at appropriate points in the curriculum for all who need it, in order to equalise opportunities for learning and progression across the student body, as far as this is feasible.

The design challenge for curriculum developers is to find innovative and effective ways to do this while maintaining curriculum coherence, through, for example, exploring pacing and sequencing and the extent to which these can allow for flexibility in progression. The detailed report in Appendix 2 shows the outcome of the group's thinking. In particular, the Detailed Design Principles in the exemplar report represent a succinct expression of what the group based their work on.

The BCom (Accounting): Much of the above commentary on the Engineering degree applies to the BCom design, but with notable differences. The working group identified two closely inter-related manifestations of differential preparedness. First, it is a feature of Commerce degrees that key subjects, including Accounting and Economics, have been taken at school by some entering students but not by others. There is an obvious case for making separate introductory provision for these two groups, yet this is often not effective. Some students cope very well with the regular first course in Economics or Accounting without any prior formal learning in these subjects, while others who have done them at school flounder from early on. The reasons for this are complex. They include the nature of the school curricula and quality of teaching there, but go beyond this into more fundamental issues of general educational experience, learning approaches, self-confidence and social capital. Dealing with these phenomena in practical curriculum design involves significant challenges regarding alternative starting points and, in particular, placement

mechanisms for guiding students into the curriculum path that gives them the best probability of succeeding.

Second, a closely-related challenge (in many respects it is the same one) is that the learning of many students is undermined by an absence of the kind of ‘contextual knowledge’ (as the working group terms it) that is needed and taken for granted in an Accounting degree programme. To use a basic example, a student with little or no experience of banking or the commercial world faces major difficulties in advanced courses in Finance or Management Accounting if this prior knowledge is simply assumed. As in the case of the Engineering degree, the only solution is to create space for developmental provision, and the design challenges are the same as for the engineers.

The BSc: Because of the nature of the subjects and the realities of current student intakes into Science, the emphasis in the BSc is strongly on dealing effectively with the articulation gap through entry-level provision that makes realistic assumptions about prior knowledge, and ensuring that the curriculum as a whole develops coherently, without the step-changes in difficulty and volume that have come to characterise many BSc programmes. The diagrammatic representations of the curricula are deceptively simple but are underlain by key challenges in re-thinking the ordering and progression of subject matter and the integration of key forms of learning support, including language development.

The Task Team noted that the final year of the exemplar did not explicitly make provision for forms of learning designed to provide distinctive deepening of knowledge and to stimulate and guide the maturation of students towards critical, integrated and independent thinking. It is appreciated that the current structure of the BSc in most institutions does not lend itself to provision of this kind (such as capstone courses), but it is hoped that curriculum development of the kind made possible by the proposed new structure will make this possible.

The BA/BSocSci: In various respects, the Humanities first degree has proved to be the most difficult to reconceptualise within a flexible structure. This is primarily because progression in learning in the Humanities does not lie so much in content knowledge developing cumulatively, as in most SET subjects, but rather in the quality and complexity of intellectual engagement with the content and its key concepts. Thus the kind of readings given in a first-year Humanities course may be similar to that in a final-year course, but the kind of engagement with the readings that is required at the two academic levels will be very different. Distinguishing between different levels of preparedness, and the consequences for curriculum design, are therefore particularly challenging in the Humanities – as is the question of placement – because of the centrality of academic literacies and conceptual development.

The working group has developed an approach that emphasises foundational learning – particularly in relation to conceptual development, induction into disciplinary discourses, and academic literacies – in the early stages of the programme, using authentic content but strictly limiting the volume of this in order to prioritise the development of sound academic foundations. The model then provides for a steadily decreasing level of support higher up the curriculum. It is recognised that Arts and Social Science curricula are very varied, so this approach to designing

a flexible structure is offered as one viable example. Different approaches may suit different knowledge fields.

The Engineering diploma: As in other examples, the nature of the curriculum and the student intake has led the working group to focus strongly on the articulation gap and the early formative stages of the programme. A key difference from the other programmes is that foundational skills in the Engineering diploma extend well beyond academic subjects into, for example, engagement with machines and practical aspects of technology. Again, invalid assumptions can have a profoundly damaging effect on students' capacity to learn throughout the curriculum.

Extending the development of curriculum exemplars

Taken collectively, the exemplars offer important insights into the challenges and potential rewards of designing a flexible curriculum structure, and provide concrete examples of such designs. The work of the groups provides clear evidence of the value of expert curriculum analysis in developing effective approaches to the realities of students' educational backgrounds.

The exemplars offer a valuable basis for further curriculum analysis and development in the institutions. The development of further exemplars, as well as the elaboration of these, will be a key contribution to implementing the new structure. Possible approaches to coordinating and supporting such work are discussed in Chapter 9.

7.7 Admissions and placement

An essential complement to structural flexibility is the capacity to guide students into the curriculum pathway that will offer them the best opportunity to succeed. The higher education sector will therefore need to continue developing expertise in student 'placement' – that is, ensuring as far as possible that students enter their degree or diploma programme at the level that best suits their prior educational experience.

While individual responsibility is clearly important, students are often not in a position to judge which curriculum route would best suit their needs. This places an educational obligation on institutions to apply academic judgment, to the best of their ability, in directing students to the route most likely to lead to their succeeding. The effectiveness of instruments for assessing students' achieved learning and potential – including the National Senior Certificate in its various forms, specifically designed entry-level tests such as HESA's National Benchmark Tests (NBTs), and institutional assessment mechanisms – is important for supporting informed and fair placement decisions.

At present, placement refers to deciding whether a student is admitted to a mainstream or an extended programme. Under the envisaged new dispensation, however, the position would be turned around. The majority of students would enter the core four- or five-year programmes as the standard offering, and placement would consist in determining whether students should be permitted to progress more rapidly. As now, placement decisions would need to be informed by effective assessment of students' capacity, but the emphasis would shift to achieved learning and preparedness, which can be more readily assessed than potential.

The new curriculum norm would go some way towards resolving the conundrums and contestations that have troubled higher education admissions policy and practice since the 1980s. Nevertheless, it is envisaged that work on the theory and practice of selection, admissions and placement will continue to be important in higher education, for reasons such as the following:

- Developmentally-orientated student selection, admissions and placement processes – that is, processes that are founded on a commitment to identifying and helping to realise student potential, particularly when it is masked by educational disadvantage – will remain essential in South Africa’s environment of extreme inequalities. As the participation rates show, equity of access is far from having been achieved. Achieving it in the South African context requires an effective combination of vision, policy, rigorous research and innovative assessment instruments. This will continue to apply.
- Similarly, the translation of equity in access into equity in output does not happen spontaneously but depends on the capacity of the teaching and learning process to respond to the realities of the student body. There is an iterative relationship between selection and placement, on one hand, and curriculum on the other: for example, flexibility in curriculum structure is essential to the success of an inclusive access policy, in that it enables students from diverse backgrounds to realise their potential; and effective placement is needed to make the most of a flexible structure.
- Research into selection and placement also has diagnostic power in relation to student learning, particularly the match between student preparedness and the assumptions of the curriculum. Entry-level assessment can provide a picture of what students know and can do. It can therefore make a significant contribution to developing the teaching and learning process. However, the potential of this contribution has not yet been realised, particularly because current curricula have little manoeuvrability to respond to diagnostic information of this kind.

In short, ongoing work on admissions policy and student selection and placement will be important in realising the potential of the new curriculum structure to meet equity and development goals. All the exemplar reports stress the importance of principled and transparent placement policy and mechanisms. It is clearly essential that placement policy and practice should not be used to manipulate enrolments or for institutional marketing, but must be driven solely by what is in the best interests of the students’ advancement.

7.8 An alternative option for dealing with differential levels of preparedness

As noted earlier, providing for diversity in educational background is a central requirement of South African curricula. This report proposes a flexible curriculum structure, as elucidated in this chapter, as the optimal and most practicable model for allowing for diversity. The Task Team has recognised, however, that a possible alternative approach would be to lengthen the duration of first degree and diploma programmes with no provision for completion in less than the formal minimum time. Assuming that it would not be expected that all students would again have to follow exactly the same curriculum path – which would defeat the goal of providing for diversity – this model would entail well-prepared students using the additional time for enrichment courses.

The Task Team has considered this idea carefully but has not accepted it. Moving from the current rigid curriculum structure to another rigid (albeit more appropriate) one would privilege structural uniformity over the underlying importance of explicitly recognising and addressing the structural implications of diversity. This would risk introducing new forms of inequality. The Task Team considers that the mooted alternative approach would be inequitable in two important ways:

- First, it would result in there being in effect two versions of each qualification, a standard one and an enriched one, which would inevitably have differential personal, social and market value. Students from disadvantaged backgrounds would predominantly achieve only the standard qualification, so inequalities would be perpetuated.
- Second, providing state funding for four full years of study for all students would represent an unnecessary public cost, which would also be inequitable in that the state would be paying for enrichment for some students and not others, and the majority of the beneficiaries would be likely to be students who were already advantaged.

The Task Team consequently resolved not to propose this option.

7.9 Conclusion

The proposal for a flexible curriculum structure advanced in this chapter is underpinned by empirical data analysis, research undertaken by the Task Team, the argument advanced in prior chapters, and the testing of the emerging principles through the development of concrete exemplars by specialist curriculum development groups. Together these lead to the conclusion that the introduction of a flexible curriculum structure for South African undergraduate education is the best available option for achieving the purposes outlined at the beginning of the chapter: in short, substantially improving graduate output in terms of numbers and equity, and enhancing the quality of degrees and diplomas and their relevance in the contemporary world.

8. Implementation: Implications for higher education policy and funding

Chapter overview

The case that has been made in the foregoing chapters for a flexible curriculum structure to improve the completion rates in undergraduate higher education is here examined to establish the affordability and feasibility of implementing it. In order to calculate the additional funding that would be required, current cohort flows are used as a basis on which to model improved flows resulting from the introduction of the flexible structure, and to translate these into subsidy and other costs. The difference from the status quo represents the extra costs that would be entailed.

In addition, in order to assess whether the proposed model represents an efficient and cost-effective approach to improving graduate output, alternative scenarios are modelled for comparative purposes. The chapter thus presents two additional scenarios, both of which depend on increasing the student intake, rather than on structural change, for growing graduate output.

The projections presented indicate that the flexible curriculum structure would produce 28% (about 15,000) more graduates than the status quo from the same intake cohort, at an additional subsidy cost of only 16%, reflecting a significant increase in efficiency. To produce the same increase in graduate output, the alternative scenarios would require substantially larger student intakes and state subsidy. A realistic alternative scenario is projected to require 37% more entering students and more than double the additional subsidy needed for the flexible structure.

In addition to direct costs, the chapter examines the implications of the flexible curriculum structure for NSFAS funding, infrastructure costs, academic staff numbers and costs, and costs to the student, and finds it more advantageous than the alternative scenarios in all these respects. This analysis has significant implications for the DHET's intention to expand higher education and to improve its affordability to students as a means of widening participation.

The conclusion from the projections is that, since it would produce more graduates than the status quo at a lower unit cost, the proposed flexible structure should be implemented in order to improve higher education's utilisation of human and material resources and its return on public and private investment. Moreover, in comparison with the alternatives examined, it is also the most cost-effective way of progressing towards the growth goals of the Green Paper and the National Development Plan, and the least wasteful of resources.

8.1 Introduction: Modelling options for increasing graduate output

The proposal for lengthened curricula as the norm for undergraduate degrees and diplomas is a system-wide response to a systemic problem and thus has implications for implementation at that level. There are four main areas relating to whether the proposal can be implemented in practice. The first of these, and perhaps the most pressing consideration, is the affordability of the proposed structure and how such a development may be funded. (The consideration of affordability applies both to the state and to students and their parents or sponsors.) The second relates to feasibility in terms of the human resources capacity and expertise needed to ensure the success of the new curriculum structure. The third consideration is the extent to which system-level higher education policies and qualifications frameworks would need to be modified to enable the introduction of the new norm. The fourth relates to overall system readiness to implement such reform.

The case for reform is based on the need for improving graduate production in terms of numbers, quality and equity, for increasing the effectiveness of the educational process in higher education, and for improving internal efficiency through reducing wastage of human and material resources. There will inevitably be a direct cost to the state attached to producing more (and better) graduates from the whole population. Thus, in relation to resources, the question is what model will best limit the increased cost of producing such additional graduates. In the context of scarce resources, a related question is what model will best reduce the wastage of intellectual talent that occurs in the system at present.

The Task Team therefore commissioned the development and analysis of a range of scenarios to assess the resource requirements of the proposed flexible curriculum structure and of other possible output improvement models. The scenarios focus on the direct costs to the state, covering all relevant subsidy elements of the funding framework as well as estimated NSFAS costs, but serve also as a basis for commentary on the implications for academic staffing, space and infrastructure, and cost to students.

The three scenarios that have been selected as most relevant to the investigation, together with the assumptions they are based on, are set out in Section 8.2. The full research paper, Sheppard (2013), is available at www.che.ac.za.

8.2 Scenarios relating to resources

All the scenarios are limited to first-time entering students at the contact institutions, that is, excluding UNISA. They project data for six years or seven years, depending on qualification type. In summary, the scenarios are:

- **Status quo:** Reflecting the current position.
- **Scenario 1:** Reflecting the flexible curriculum structure proposed in this report.
- **Scenario 2a:** 'Increased intake with existing average throughput rates'. If existing performance patterns continue, a larger intake will be required to produce more graduates.
- **Scenario 2b:** 'Increased intake with reduced average throughput rates'. A variant of 2a, this scenario assumes that the additional intake will be less prepared on average than the current one, and will thus have a lower throughput rate.

The assumptions underlying the scenarios are key to their validity, and have been arrived at on the basis of analysis of relevant sector-wide performance patterns. The quantification of the various scenarios has taken the form of estimating change in attrition and throughput rates for each year of a cohort, relative to the status quo.³²

The features and assumptions of each scenario are set out below.

Baseline: the status quo

The baseline position, referred to as the 'status quo' in this chapter, reflects current throughput patterns. It uses the enrolment of the 2010 intake and actual ratios drawn from the 2012 subsidy calculations, which are based on 2010 HEMIS data. The cohort flow (commonly called throughput) rates are drawn from the actual cohort flows of the 2005 and 2006 entering cohorts, the latest for which sufficient longitudinal data were available.

Scenario 1

Scenario 1 depicts the performance patterns that are expected if the proposed flexible curriculum structure is implemented. It is based on the actual 2010 intake but assumes that there will be improved average throughput rates as a result of the new structure, as outlined below.

Assumptions for Scenario 1

The assumptions underlying Scenario 1 reflect the expected advantages of the proposed flexible curriculum structure as follows:

- First, it is assumed that the number of students currently graduating in regulation time will continue to graduate in three years. Such students can be expected to be among those qualifying for exemption from all or most of the new first-level courses.
- Second, it is assumed that the students who follow the new curriculum norm will achieve improved average throughput rates because of the additional planned year of study that they will undertake within a curriculum based on realistic assumptions about their prior learning. The key features are: (a) dropout rates will be reduced, and (b) there will be improved completion rates from the new minimum time onwards.³³

The expectations of improved performance among students taking the new curricula are based on the following:

- The educational analysis assembled for this report points to primary systemic reasons for poor performance in the system. The key learning-related factor is assumptions about

³² The data on which the estimates are based include the current cohort flows of each of the qualification types studied (i.e. three-year Bachelor's degrees, three-year diplomas and four-year professional degrees) and, where applicable, the quantitative performance data available for extended programmes. Thanks are due to Professor Charles Simkins and Dr Charles Sheppard for providing data analysis expertise in this process.

³³ The details of the assumptions for all scenarios are given in Sheppard (2013). In Scenario 1, for example, as shown in Table 7 in Sheppard (2013), the first-year attrition rate in all three qualification types is projected to drop by 30% because the foundational elements of the new first-year courses will improve retention; and in the year when the first graduates of the new curricula come through, the number of students graduating is projected to increase (by a percentage calculated specifically for each qualification type). The cumulative effects of such changes are carried through the full cohort period, resulting in improved final completion rates for the cohort.

- prior learning that are not appropriate for the majority of the student intake, because of their educational background, rather than lack of intellectual potential. It follows that, if the systemic faults are decisively identified and addressed, there will be improved performance.
- The expectations also draw on evidence from performance in existing extended curriculum programmes, which have been shown to be effective in facilitating success and better completion rates for at-risk students (see Chapter 5). There are grounds for expecting the proposed new curriculum norm to produce significantly better performance than existing extended programmes. The grounds are two-fold. First, (as outlined in Chapter 5) serious constraints on the design of extended programmes have limited their effectiveness. The introduction of mainstream curricula with similar developmental aims but without the attendant constraints will be conducive to improving teaching and learning. Second, the target group of extended programmes has, in practice, comprised students who are highly at risk, generally representing the lowest 10%-15% of each institution's intake in terms of educational attainment. In contrast, it is expected that the majority of the intake will follow the new curriculum norm. This group will on average have a substantially higher level of prior attainment than the current extended programme intake.

The assumptions underlying Scenario 1 have thus been quantified on the basis of analysis of the current overall cohort flows and the performance data available for extended programmes.

Aside from the specific details, the essence of Scenario 1 is that it illustrates the effects of improving the appropriateness and internal efficiency of the teaching and learning process.

Scenario 2

Scenario 2 has two variants. They have in common the assumption that, in the absence of any systemic intervention, the current performance patterns will not improve. In this case, unlike Scenario 1, the goal of improving graduate output can only be met if the student intake is increased. This approach is referred to as the 'increased-intake' approach. **To allow for comparison with Scenario 1, the modelling of the two variants of Scenario 2 is based on a calculation of what additional intake would be required in order to produce the same number of graduates as Scenario 1.**

Assumptions for Scenario 2a

The first variant, Scenario 2a, assumes that the average throughput rates of the current intake will apply to the whole of the increased intake, i.e. to the additional students as well. This scenario is thus based on no change in the throughput and attrition rates of the status quo. However, as outlined below, it is unlikely that, within the existing curriculum structure, current performance patterns can be maintained if the intake grows. Scenario 2a is therefore presented as a best possible case for the increased-intake approach.

Assumptions for Scenario 2b

Scenario 2b assumes that the preparedness of the additional students that would be admitted would be lower than the average of the present intake. The reasons for this are discussed in Section 6.4. For example, while the present intake includes an appreciable proportion of well-

prepared students (including the 27% that graduate in regulation time), there would be few such students in the additional intake. Moreover, while the additional students may well have as much academic potential as the current intake, they are likely, on average, to have a lower level of prior attainment than current extended programme entrants, and would have a low probability of succeeding within the existing mainstream curriculum structure. Widening the intake would thus be likely to increase attrition, and would also create a need for major expansion of the current model of extended programmes. For these reasons, the assumptions underlying Scenario 2b are likely to be more realistic than those of Scenario 2a, but both are presented in the interests of comparison.

The projections for Scenario 2b are calculated separately for the two notional constituent groups – the current intake and the additional students – which are then aggregated. The throughput assumptions for that section of the intake equating to the current total intake follow the status quo. The approach to establishing the cohort flow for the additional intake was essentially the same as was used for Scenario 1, with changes in attrition and completion rates being estimated on the basis of existing overall performance patterns and data on extended programmes.³⁴

These scenarios have been used to assess the resource implications of improving graduate output in terms of (a) direct state subsidy, (b) NSFAS contributions, (c) academic staffing, and (d) infrastructure, as set out below.

8.3 Higher education funding: Cost to the state

At the heart of the issue of the feasibility of the proposed new structure is the question of affordability. In considering the financial feasibility of the proposal from the state's perspective, it is necessary to consider two key questions:

- What would be the additional direct costs to the state, in terms of subsidy and NSFAS contributions, of implementing the proposal put forward in this report?
- What would be the comparative costs of different approaches to improving graduate output (i.e. comparing Scenarios 1, 2a and 2b)?

Through the DHET, the state funds higher education institutions using a combination of block and earmarked grants. Of the block grants, 47% comprises the teaching input grant, based on student enrolments, and 4.1% comprises the teaching output grant, based on graduate production. Clearly, the aspect that would be most affected by the proposed increase in formal time is the teaching input grant, which is calculated according to **teaching input units**, which are derived from student enrolments relative to full course loads ('full-time equivalent students' or FTEs). As the **teaching output grant** is a far smaller proportion of the subsidy, the effect of changes in this component would be proportionately less. Other enrolment-sensitive aspects affecting funding are the **institutional adjustment factor for disadvantaged students** and **NSFAS funding**.

³⁴ The details of Scenario 2b are shown in Table 8 in Sheppard (2013). The assumptions on which the cohort flows for the *additional* student intake have been calculated include the following (with current overall figures shown in brackets): (a) that 10% of the additional students will graduate in the regulation time (currently 27% for the full intake); and (b) that the cumulative completion rate after six years will be 40% for three-year degrees (52%), 31% for diplomas (40%), and 35% for four-year degrees (49%). (The latter figures are based on current performance patterns.) If the existing structures are not changed, this level of performance will be difficult to achieve for the profile of the additional students, who are currently not gaining access to higher education at all.

Extensive modelling undertaken for this investigation has examined the cost implications to the state of the two main possible approaches to improving graduate output, viz. (a) the proposed flexible curriculum structure; and (b) increasing the intake without changing the teaching and learning process (i.e. Scenarios 2a and 2b). Each of the approaches is examined below, and their funding implications are then compared.

Methodology

For each of the three qualification types studied, longitudinal enrolment and cost projections for each of the three scenarios outlined in Section 8.2 have been determined. The projections are for six years for the current three-year qualifications and seven years for the current four-year degrees (i.e. three years beyond the current regulation time for each type). The model takes into account all relevant components of the funding framework, viz. teaching input units, teaching output units, the institutional factor for disadvantaged students, and NSFAS funding. The subsidy and NSFAS costs are calculated separately, then also shown in aggregate. The modelling includes separate calculations for the four major fields of study – viz. Science, Engineering and Technology (SET); Business and Management Sciences; Education; and Other Humanities – as these fields have differential subsidy weightings.

In summary, the model first converts headcounts to full-time equivalent (FTE) enrolments. It then converts the FTEs into teaching input units (retaining the existing weighting of 1.5 for the final year of current four-year professional degrees, as opposed to 1 for all years of the other qualification types); converts graduate numbers to teaching output units based on the current weights for each qualification type; and includes the institutional factor for disadvantage based on the average factor of additional teaching input units that pertained in the 2010 subsidy calculations. The rand value of NSFAS allocations is calculated separately, based on the current assumption that 20.5% of students will be eligible for NSFAS funding. The rand values for subsidy are based on the actual rand values for 2012, with an assumed 5% inflationary increase per annum. The NSFAS allocations assume a 10% increase based on the allocation trends in recent years as government attempts to fund a greater portion of the full cost of study.

Findings on cohort flows: Patterns of enrolment, graduation and attrition

Using HEMIS data based on enrolment figures for 2010,³⁵ and assuming the different cohort flows outlined in Section 8.2, projections have been made of the intake and enrolment patterns and the numbers of graduates and dropouts expected in the three scenarios, in comparison with the status quo.³⁶ The main findings on the performance patterns are outlined below.

The general (currently three-year) Bachelor's degrees are used here to provide a detailed example of the projections for the different scenarios. Briefer comments are offered on the other qualification types studied.³⁷

³⁵ These HEMIS data were the latest available at the time of the study.

³⁶ The status quo cohort flows are an average of the actual cohort flows of the 2005 and 2006 entering cohorts, the latest for which sufficient longitudinal data were available at the time of the study.

³⁷ The full details for each of the qualification types studied, broken down by subject area, are provided in Tables 8.2a and 8.2b in Sheppard (2013).

Intake, graduation and attrition patterns in the general Bachelor's degree

Table 12 provides an overview of the intakes and the outflows (graduates and dropouts) for each scenario of the general Bachelor's degree. The modelling uses the following parameters to enable key comparisons to be made:

- To show the additional graduate output that Scenario 1 is projected to achieve, **Scenario 1 is based on the same intake as the status quo.**
- To allow for comparison of effectiveness and efficiency in use of resources between the scenarios, **the graduate output of Scenarios 1, 2a and 2b is held constant**, based on that of Scenario 1. The model thus calculates what it would take for Scenarios 2a and 2b to produce the same number of graduates as Scenario 1.

Table 12: Intakes and projected graduates and dropouts in the general Bachelor's degree, by scenario^{38,39}

		Status Quo	Scenario 1	Scenario 2a	Scenario 2b
Headcounts	Intake	42,277	42,277	53,762	58,114
	Graduates	21,606	27,448	27,448	27,448
	Dropouts	20,671	14,829	26,314	30,666
Number of dropouts per 100 graduates		95	54	95	112

Intake and graduation patterns

- Scenario 1 will require no additional student intake to improve graduate output, producing about 5,800 (27%) more graduates than the status quo from the same entrant profile.
- In contrast, Scenario 2a – representing the best possible expansion of the status quo structure – would require over 11,000 (27%) more entrants than Scenario 1 to produce the same number of graduates. Scenario 2b would require an additional intake of nearly 16,000 (37%).

Attrition patterns as indicator of educational effectiveness

The attrition patterns highlight the educational effectiveness of the different scenarios and the extent to which they make efficient use of human and material resources. A key measure is the ratio between graduates and dropouts, expressed in the table above as the number of dropouts per 100 graduates. The main points are the following:

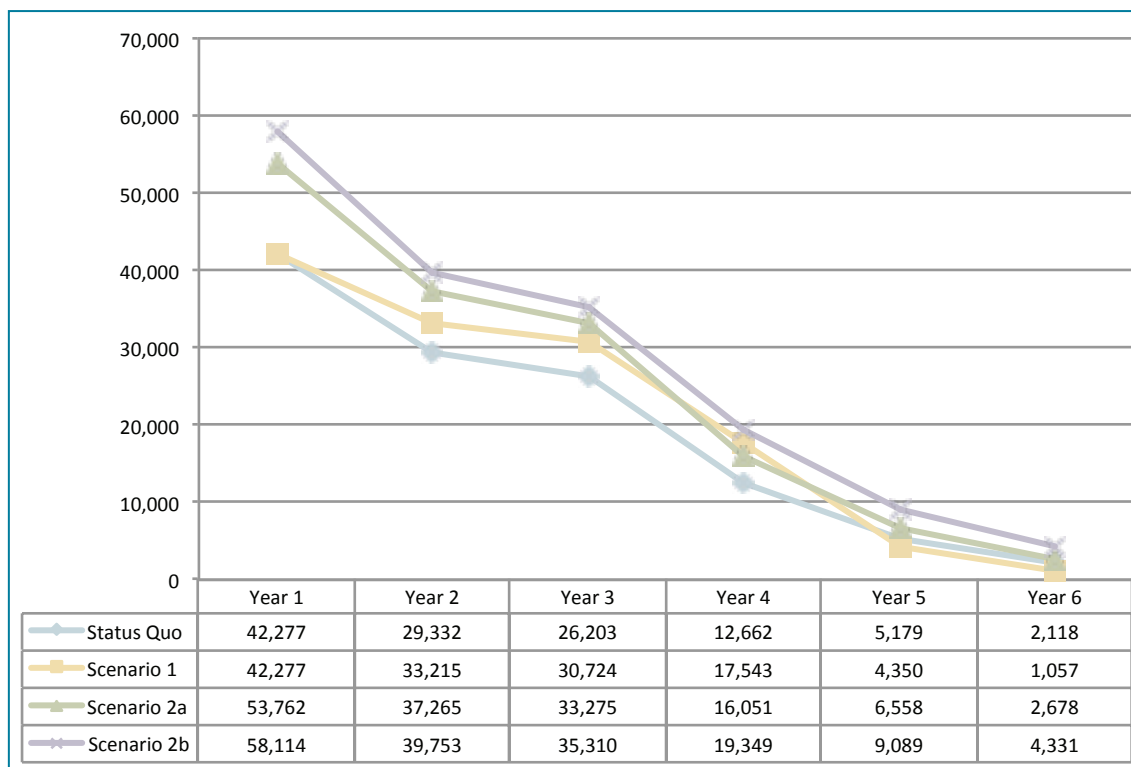
³⁸ Small discrepancies between the numbers in these tables and those in the detailed tables in Sheppard (2013) arise because of rounding off and the nature of the calculations. The numbers in these tables reflect the key parameters of the model, viz. that the intakes for the status quo and Scenario 1 are the same, and graduate output is the same for the three change scenarios.

³⁹ The dropout figures are marginally higher than the actual numbers because they include an unknown number of students who might have remained in the system after the cohort period.

- Since Scenario 1 has the same intake as the status quo, the gain in graduates corresponds to the decrease in dropouts; in effect, Scenario 1 would turn about 5,800 of the current student intake from dropouts into graduates. This results in a major improvement in the ratio between graduates and dropouts: the number of dropouts per 100 graduates in Scenario 1 is only 54, as opposed to 96 in the status quo.
- The number of dropouts increases markedly in Scenarios 2a and 2b: by about 10,000 in the latter. The result is that the number of dropouts per 100 graduates in Scenario 2b is more than double that in Scenario 1.
- The deterioration in the dropout-to-graduate ratio from Scenario 2a to Scenario 2b indicates that, if the educational process does not become more effective, the number of dropouts is likely to grow more quickly than the number of graduates.

Enrolment patterns in the general Bachelor's degree

Figure 9: Enrolment patterns in the general Bachelor's degree required to produce the same number of graduates in each scenario: Headcount registrations at the beginning of each year of one cohort



The enrolment patterns for each scenario – that is, the intake and the year-by-year enrolments for the duration of the cohort – are critical because they are the basis for key costs in the system, including teaching input subsidy and NSFAS costs, which form the major part of the cost to the state, and staffing and infrastructure costs. Figure 9 shows the patterns for the general Bachelor's degree.

The marked points in this figure show the total enrolments in each year of one cohort for each of the scenarios, so the graph illustrates their different retention patterns. Since enrolment patterns

per cohort are determined by both graduation and attrition, retention *per se* is not a positive indicator unless it leads to graduation. Hence the comparability of these patterns as a measure of effectiveness depends on the extent to which they lead to the same positive outcomes. In this model, the change scenarios (1, 2a and 2b) are fully comparable because they produce the same number of graduates. The status quo is not directly comparable with the change scenarios in terms of efficiency because it produces fewer graduates. It is shown here only to indicate the present enrolment flow.

The question addressed by this graph is what total enrolment is involved, over the full cohort period, in producing a given number of graduates: the lower the total enrolment (which can be expressed as the total number of annual registrations), the greater the efficiency. This applies to human resources (avoiding unproductive use of staff time and student talent) and to cost-effectiveness. Since enrolment is the basis for teaching input subsidy and NSFAS awards, it provides a broad comparative indicator of the main costs to the state of the different scenarios: in general, the bigger the enrolment, the higher the costs.

The graph shows the following:

- Compared with the status quo, Scenario 1 shows higher enrolments in Years 2–4 because of improved retention, then a sharp decrease, reflecting a greater number of graduates within four years. This can be seen as a positive retention pattern since it leads to an improved completion rate.
- Scenarios 2a and 2b show significantly higher enrolments than the status quo and Scenario 1, but this results from greater intake rather than greater efficiency. Thus Scenario 2a requires the system to accommodate over 20,000 (16%) more registrations over the six-year period than does Scenario 1, to produce the same number of graduates. The figure for Scenario 2b is 36,780 (28%) more registrations.

The cost and staffing implications are discussed later in this chapter.

Cohort flows in the diplomas and the professional Bachelor's degrees

As shown in Sheppard (2013), Tables 8.1a and b and 8.3a and b, the cohort flows in the diplomas and the professional Bachelor's degrees are broadly similar to those in the general Bachelor's degrees. The differences include the following:

The diplomas

The diplomas at present have the poorest completion rates of the three qualification types studied, so improved efficiency, coming from this low base, makes a particularly marked difference to the performance patterns.

- In comparison with the status quo, Scenario 1 produces about 5,500 (30%) additional graduates per cohort in six years, reducing the number of dropouts concomitantly. Retention is higher than in the status quo in all six years, and the number of graduates is likewise significantly higher in years 4–6.

- In Scenarios 2a and 2b, of the three qualification types the diplomas require the largest growth in intake to produce the same number of graduates as Scenario 1: over 13,000 (30%) and 18,000 (40%) respectively. They also generate the largest increases in the number of dropouts relative to the status quo: about 8,000 (30%) and 12,500 (47%) respectively. There are higher attrition than completion rates in these scenarios: for every 100 graduates, there are 146 dropouts in Scenario 2a and 165 in Scenario 2b, compared with 89 in Scenario 1. This illustrates the relative inefficiency in the use of resources that is inherent in the increased-intake scenarios.

The professional Bachelor's degrees

In view of their longer duration, the cohort flows for the professional Bachelor's degrees have been calculated over seven years. Notwithstanding their generally higher entry criteria, the performance patterns in this qualification type are very similar to those of the general Bachelor's degrees. The full performance patterns are set out in Tables 8.3a and b in Sheppard (2013). Some salient points are as follows:

- The additional intakes required in Scenarios 2a and 2b are approximately 7,000 (26%) and 11,000 (38%) respectively. Given current NSC results, it is not clear where such substantial numbers of candidates for these degrees could be found, particularly as most of the programmes require proficiency in Mathematics. In contrast, the more realistic prior-knowledge assumptions allowed for in Scenario 1 would increase the pool of candidates to some extent.
- Compared with the status quo, Scenario 1 shows improved retention up to Year 5, followed by a marked drop in enrolment that reflects a higher completion rate within five years. In the other scenarios, more students remain in the system beyond Year 5. Particularly as the final year of a professional Bachelor's carries double the usual teaching input subsidy, this has important cost implications, as discussed in the section below.
- In line with the patterns in the other qualification types, Scenario 1 improves the ratio between graduates and dropouts. For every 100 graduates, there are 53 dropouts in Scenario 1 compared with 93 in Scenario 2a and 112 in 2b. The absolute number of dropouts projected in the latter scenario, more than 20,000 per cohort, indicates unsustainable wastage of potential high-achievers in key skills areas.

The patterns of utilisation of the country's talent shown in this section are clear: improving the effectiveness and efficiency of the educational process in higher education carries major benefits for development and equity at national and individual level. The next section translates the performance patterns into the direct costs to the state of the different scenarios, as a basis for considering feasibility and cost-efficiency.

Cost to the state: For each cohort⁴⁰

The first stage in determining the financial projections is calculating the direct costs to the state, in terms of subsidy and NSFAS, **for a single cohort** in each of the scenarios, enabling the basic costs of the different scenarios to be compared with one another and with the status quo.⁴¹

The following two tables provide a summary of the per-cohort financial projections, in the context of a summary of the enrolment, graduation and attrition patterns analysed above. Table 13 shows the direct subsidy costs, while Table 14 incorporates NSFAS costs, as these can be regarded as essential direct costs.

It may be noted again that the model holds the number of graduates constant across the three scenarios so that direct comparisons can be made of the inputs needed: the total student intake required, the total direct cost to the state, the cost per graduate, the growth in intake required, and the additional direct cost. The growth percentages shown and the additional costs per cohort are in relation to the status quo.

⁴⁰ The detailed methodology used for the financial projections is set out in the Methodology section of Sheppard (2013) on www.che.ac.za

⁴¹ The details of the procedures and calculations are provided in Tables 9 and 10 of (Sheppard 2013): the conversion of headcounts to FTE enrolments, then to subsidy units and NSFAS student units (Tables 9a-9c); and the conversion of the subsidy and NSFAS units into rand values for one cohort (Tables 10a-10c).

Table 13: Comparative per-cohort inputs and outputs of different models for increasing graduate production, by qualification type: NSFAS costs excluded General Bachelor's degrees

General Bachelor's degrees

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
Intake	42,277	42,277	53,762	58,114
Graduates	21,606	27,448	27,448	27,448
Total cost (millions)	R2,583 m	R2,929 m	R3,289 m	R3,600 m
Cost per graduate	R 119,572	R 106,700	R 119,817	R 131,147
Intake growth required (%)	-	0	27	37
Graduate growth (%)	-	27	27	27
Cost growth (%)	-	13	27	39
Additional funds required per cohort (millions)	-	R345 m	R706 m	R1,016 m

Professional (4-year) degrees

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
Intake	28,281	28,281	35,569	39,141
Graduates	14,650	18,455	18,455	18,455
Total cost (millions)	R2,817 m	R3,255 m	R3,518 m	R3,881 m
Cost per graduate	R 192,288	R 176,363	R 190,646	R 210,276
Intake growth required (%)	-	0	26	38
Graduate growth (%)	-	26	26	26
Cost growth (%)	-	16	20	27
Additional funds required per cohort (millions)	-	R438 m	R701 m	R1,064 m

Diplomas

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
Intake	45,217	45,217	58,672	63,217
Graduates	18,400	23,838	23,838	23,838
Total cost (millions)	R2,615 m	R3,085 m	R3,384 m	R3,609 m
Cost per graduate	R 142,095	R 129,395	R 141,940	R 151,397
Intake growth required (%)	-	0	30	40
Graduate growth (%)	-	30	30	30
Cost growth (%)	-	18	29	38
Additional funds required per cohort (millions)	-	R470 m	R769 m	R994 m

Table 14: Comparative per-cohort inputs and outputs of different models for increasing graduate production, by qualification type: NSFAS costs included

General Bachelor's degrees

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
Intake	42,277	42,277	53,762	58,114
Graduates	21,606	27,448	27,448	27,448
Total cost (millions)	R3,182 m	R3,600 m	R4,049 m	R4,440 m
Cost per graduate	R 147,267	R 131,156	R 147,507	R 161,749
Intake growth required (%)	-	0	27	37
Graduate growth (%)	-	27	27	27
Cost growth (%)	-	13	27	40
Additional funds required per cohort (millions)	-	R418 m	R867 m	R1,258 m

Professional (4-year) degrees

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
Intake	28,281	28,281	35,569	39,141
Graduates	14,650	18,455	18,455	18,455
Total cost (millions)	R 3,306	R 3,808	R 4,131	R 4,569
Cost per graduate	R 225,656	R 206,337	R 223,854	R 247,600
Intake growth required (%)	-	0	26	38
Graduate growth (%)	-	26	26	26
Cost growth (%)	-	15	25	38
Additional funds required per cohort (millions)	-	R502 m	R825 m	R1,264 m

Diplomas

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
Intake	45,217	45,217	58,672	63,217
Graduates	18,400	23,838	23,838	23,838
Total cost (millions)	R3,258 m	R3,855 m	R 4,219 m	R 4,508 m
Cost per graduate	R 177,090	R 161,707	R 176,975	R 189,117
Intake growth required (%)	-	0	30	40
Graduate growth (%)	-	30	30	30
Cost growth (%)	-	18	30	38
Additional funds required per cohort (millions)	-	R596 m	R 960 m	R1,250 m

In summary, in terms of subsidy costs alone, if the three qualification types are aggregated, each scenario would produce 15,085 (28%) more graduates than the status quo, but the additional costs would vary significantly:

- **16% in Scenario 1;**
- **27% in Scenario 2a; and**
- **38% in Scenario 2b.**

When NSFAS costs are taken into account, the cost differentials between the scenarios widen marginally in the general Bachelor's degrees and diplomas and more markedly in the professional Bachelor's degrees.

The tables indicate that Scenario 1 produces the best utilisation of human and material resources and the best return on investment:

- It produces more graduates than the status quo at a lower unit cost.
- It is more cost-effective than Scenario 2a, which represents the best possible outcome of the increased-intake approach.
- Over the full cohort period, the total additional cost of Scenario 2b over Scenario 1 for one cohort of all three qualification types is approximately R1.8 billion.
- Scenario 2b shows higher cost growth than graduate growth, demonstrating that in this scenario, cost-efficiency deteriorates with system growth.

These projections have major implications for approaches to growing the higher education sector on the scale envisaged in the Green Paper and the National Development Plan.

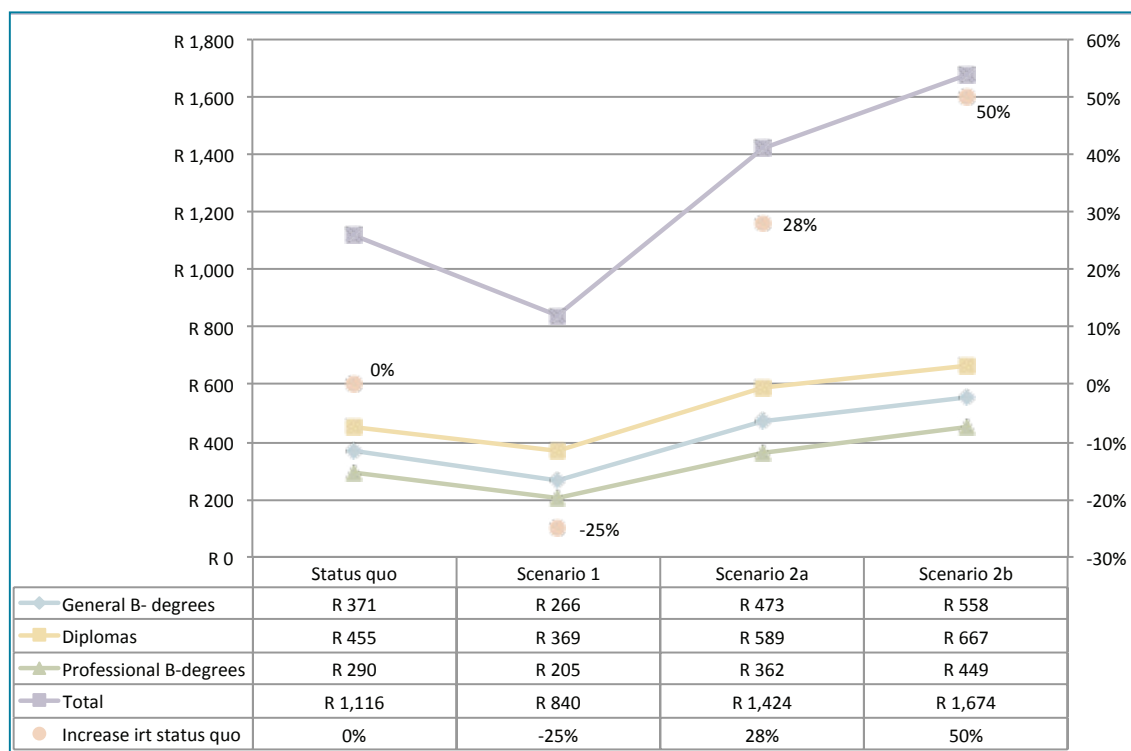
Systemic efficiency and effective use of state subsidy

In considering the additional subsidy implications of the different scenarios, account needs to be taken of the differing amounts of subsidy spent in each case that would *not* result in the production of graduates. Given that under a third of an intake currently graduates from a three-year undergraduate programme in minimum time, and that more than half the intake does not complete even in minimum time plus two, a large proportion of the current teaching input grant constitutes an inefficient and wasteful use of resources that would be better spent on facilitating greater success rates.

The attrition generated by the different scenarios, in terms of absolute numbers of dropouts as well as the ratio of graduates to dropouts, has been outlined in the section above. Figure 10 translates the dropout numbers into the rand value of subsidy spent on students who do not complete their studies within the cohort period.⁴²

⁴² See Tables 10a-10c in Sheppard (2013).

Figure 10: Unproductive use of subsidy in a single cohort, by qualification type and scenario (in millions)



The graph illustrates the following:

- Scenario 1 is less wasteful of resources than the status quo.
- Since it uses the current cohort flows, Scenario 2a highlights how the rand value of unproductive subsidy increases if the intake grows without improvement in the performance patterns.
- Scenario 2b would result in almost double the unproductive subsidy generated by Scenario 1. The Scenario 2b figures underline the fact that, unless the effectiveness of the educational process is improved, the wastage rate increases with intake growth.

Figure 10 does not take account of the amount of NSFAS funding allocated to students who do not graduate. Scenario 1 would improve the return on investment in NSFAS.

Unproductive use of subsidy is also a proxy for under-development of South Africa's intellectual talent. This under-development carries major opportunity costs for individuals and the country, and will be widely regarded as more significant and damaging than the loss of material resources.

Cost to the state: Infrastructure

Growth in the higher education system clearly requires the expansion of infrastructure, including buildings, plant, ICT and learning support facilities such as libraries, which will carry substantial capital and maintenance costs. This expenditure on infrastructure is unavoidable, and will have been factored into national plans. For this reason, the report does not cover infrastructure provision and cost projections.

However, since infrastructure costs are linked directly and indirectly to enrolment patterns, the approach to graduate growth will influence the extent of infrastructure spending that is required. In this regard, Scenario 1 will have a beneficial effect on containing infrastructure costs, through improving the ratio between expenditure and the number of graduates produced.

Similarly, the substantially higher intakes and annual enrolments per graduate that are required in Scenario 2b mean that this approach makes the least efficient use of infrastructure.

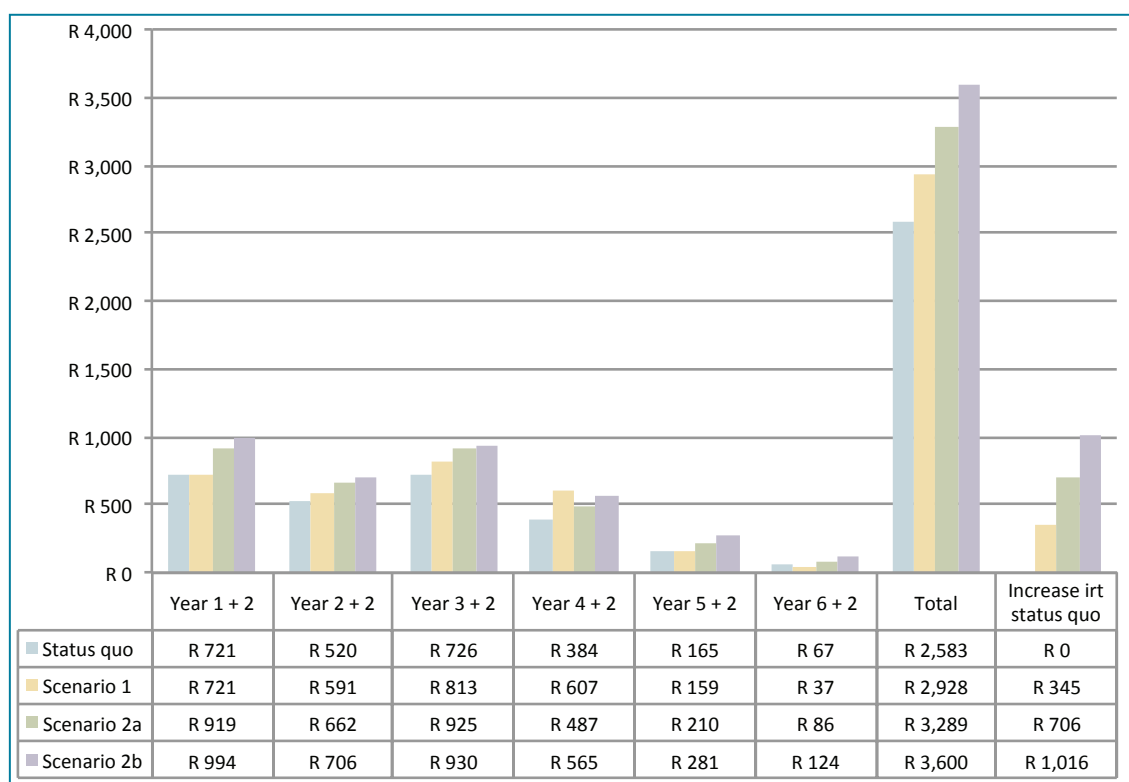
Cost to the state: Recurrent annual expenditure required

The first stage of the financial projections has focused on the costs of a single cohort, to allow for direct comparison between different approaches to increasing graduate output. Since a number of cohorts are in the system at any given time, it is necessary to calculate the total annual subsidy costs over a number of years, in order to project the actual state expenditure that would be required to implement the different scenarios, and to facilitate assessment of affordability.

As a basis for the multi-cohort projection, Figure 11 summarises the annual subsidy costs of one cohort for each of the scenarios, using the general Bachelor's degrees as an example.⁴³ It should be noted that, as teaching input subsidy is paid two years after the year in which it was generated, it is only from the third year of implementation that the additional subsidy costs of any of the change scenarios would be incurred by the state. Hence, in Figure 11, the columns refer to 'Year 1 + 2' and so on, to indicate the delay in subsidy payment.

⁴³ The costs of all three qualification types are provided in Table 13a of Sheppard (2013).

Figure 11: Summary of subsidy estimates for one cohort of the general Bachelor's degree, by year and scenario (in millions)⁴⁴



The figure shows that, in relation to the status quo, the subsidy cost of producing the specified number of *additional* general Bachelor's graduates (5,842) ranges from R345 million in Scenario 1 to R1.016 billion in Scenario 2b. As shown in Table 13a in Sheppard (2013), the equivalent figures for the diplomas (for 5,438 graduates) are R470 million and R994 million; and for the professional Bachelor's (for 3,805 graduates) they are R438 million and R1.064 billion. The **total additional subsidy required for one cohort** of all three qualification types (15,085 additional graduates) is approximately as follows:

- Scenario 1: R1.25 billion
- Scenario 2a: R2.17 billion
- Scenario 2b: R3.07 billion

Allowing for a cohort period of seven years, the average **annual additional** amount per cohort for the different scenarios would be:

- Scenario 1: R179 million
- Scenario 2a: R310 million
- Scenario 2b: R439 million

⁴⁴ Again, the three change scenarios are directly comparable because they each produce the same number of graduates. The status quo, which produces fewer graduates, is shown as a benchmark.

If it is assumed that **four cohorts** need to flow into the system to stabilise the various subsidy components, the **total average annual additional subsidy** that would be needed in the steady state (with additional inflationary adjustments in future) would be as follows:

- Scenario 1: R716 million (16% more than status quo)
- Scenario 2a: R1.240 billion (27% more than status quo)
- Scenario 2b: R1.756 billion (38% more than status quo)

In effect, these amounts represent the **average annual additional subsidy** that would be required from Year 3 of a nine-year implementation period, for the following reasons: as noted above, no additional subsidy will be payable for the first two years;⁴⁵ the professional Bachelor's calculations have been based on a seven-year cohort period; and by Year 7 + 2, the funding for the other two qualification types will have reached a steady state, so no new additional funding will be payable in that year.

In short (recalling the summary after Tables 11 and 12 above) **Scenario 1 is the most cost-effective model, requiring only 16% more subsidy to produce 28% more graduates.** The additional annual subsidy outlay represents only 5.3% of the comparable subsidy amount for 2012.

Possible sources of funding

Whatever financial arrangements the DHET is considering for funding the expansion of higher education as contemplated in the Green Paper, it is clear that implementing Scenario 1 will substantially reduce the need for additional Treasury allocations. The increase in additional recurrent funding would be cushioned somewhat by the lag in teaching input and teaching output subsidy payments.

A key consideration in assessing immediate affordability is that the proposed flexible curriculum structure (Scenario 1) would remove the need for extended curriculum programmes and thus for the current DHET foundation grant scheme that funds them. The phasing out of this earmarked grant would release approximately R200 million a year at current value. This could offset the full amount of the per-cohort additional annual subsidy requirement (R179 million), and hence substantially reduce the need for additional allocations in the early years of implementation. Even in the steady state of four cohorts being funded at any given time, the amount released from the foundation grant would contribute over 25% of the total additional subsidy amount each year (currently estimated at R716 million).

In contrast, since the other scenarios do not address the articulation gap or other systemic curriculum obstacles, the need for extended programmes and foundational provision will inevitably grow, with a concomitant increase in the demand for foundation grant funding over and above the increase in regular subsidy.

Another major source of funding related to improving student success is the Teaching Development Grant, which has an allocation of R576 million for the 2013/14 financial year. Since the goal of

⁴⁵ The need for once-off compensation to the institutions for this lag in payment is raised in Chapter 9.

the proposals in this report is essentially the same as that of the Teaching Development Grant, there is a case for utilising all or a proportion of this substantial funding for introducing curriculum reform. The funding could be applied to recurrent subsidy and/or be used for the staff development and building of curriculum design expertise that will be needed to ensure optimal implementation.

If the Foundation and Teaching Development grants were to be used for subsidy, the full additional annual costs of four cohorts (R716 million in current rands) would be covered. However, given the importance of curriculum development for optimal implementation, adequate funding for capacity building in this area will also need to be provided. This matter is discussed in Chapter 9.

Whatever sources of funding may be deemed most appropriate for implementing the flexible curriculum structure, the financial analysis indicates that, as the efficiencies take root, the new system can be expected to be self-sustaining.

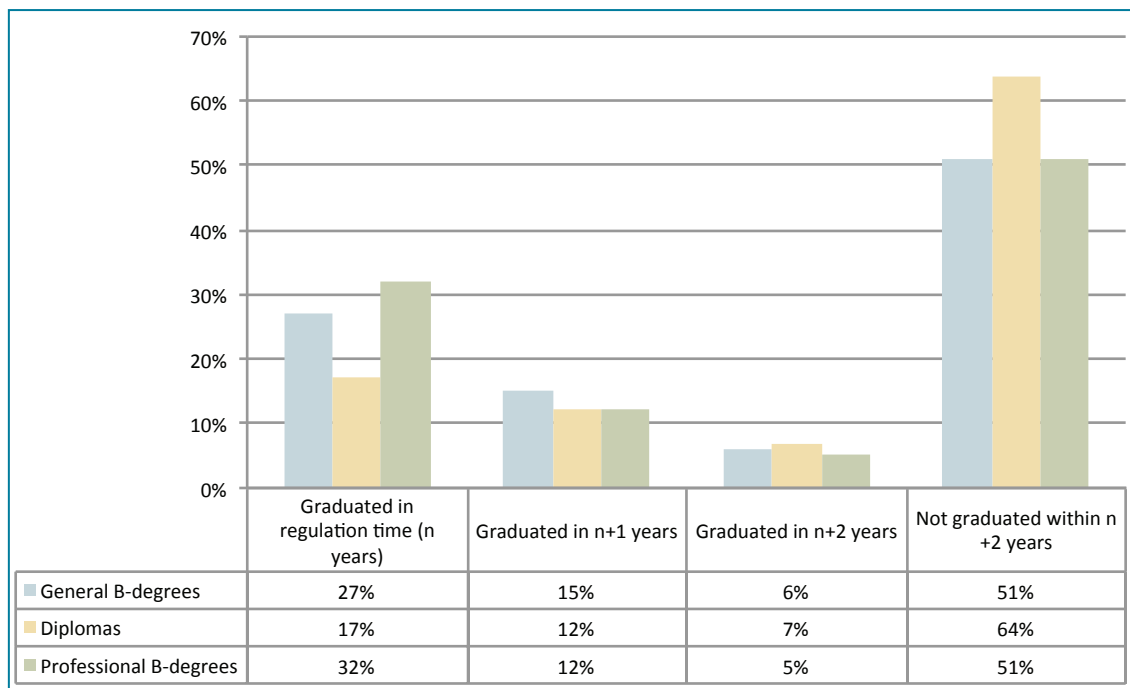
8.4 Costs to students and their families

Students, their families, bursary sponsors and others who bear the costs of students' tuition and subsistence may have a negative response to the new curriculum structure because of the perception that they will have to pay for an additional year of study. The performance patterns show that this will not in fact be the case for the great majority of students, given the following:

- There will still be a proportion of students (albeit relatively small) who will be able to graduate in the current regulation time. The advantages of dealing more effectively with diversity in educational background may well increase the number of students in this category, even if only marginally.
- All other students who graduate already take at least one additional year to complete their studies. An appreciable proportion take two or more years longer than the regulation time. For the 2005 cohort,⁴⁶ the relevant percentages are shown in Figure 12 (n is the regulation time in years):

⁴⁶ The 2005 cohort is used for these figures because of the extra year of data it provides for the professional Bachelor's degrees.

Figure 12: Percentage of the 2005 first-time entering cohort taking different periods to graduate, by qualification type: excluding UNISA



Figures derived from the above graph show that, of all the students who graduate within $n+2$ years, the following proportions take one or two years longer than regulation time: 44% of general Bachelor's graduates; 53% of diploma graduates; and 35% of professional Bachelor's graduates. As the Scenario 1 projections show, the great majority of the students in this category would be expected to graduate in n or $n+1$ years (i.e. the same period) in the new curriculum structure, so would not be subject to additional costs. In effect, money currently being spent on repeating courses would go into productive provision that would strengthen students' foundations for success.

The position is similar for the small proportion of students who currently take more than two years beyond the regulation time to graduate. Because of insufficient longitudinal data, the precise extent of this category has not yet been calculated. However, the Scenario 1 projections indicate that, because a higher percentage of the intake will graduate in the new regulation time or one year longer, a significant proportion of the students currently graduating in more than $n+2$ years would in fact graduate in less time in the new structure, and hence incur lower costs.

- In terms of life chances as well as personal costs, **the greatest beneficiaries of the new curriculum structure are likely to be those students who will never graduate in the current structure but who have the potential to succeed in the new dispensation.** In the projections, the direct comparison to be made here is between the status quo and Scenario 1, which are both based on the same intake.⁴⁷ While precise figures are not known, the numbers of students in this category will be close to the cumulative dropout

⁴⁷ See Tables 8.1a, 8.2a and 8.3a in Sheppard (2013).

numbers shown in Chapter 3, because the proportions of students who take longer than $n+2$ years to graduate, or return to studying after dropping out, are relatively small. As shown in Table 3, on the basis of available data it is estimated that **the proportion of current intakes that will never graduate is 45% for contact students and 55% for all students**. Thus this category of beneficiaries of curriculum reform is most significant because of its size and the consequences of failure that it experiences.

- Scenario 1 is conservatively projected to yield over 25% more graduates than the status quo from an intake of the same size and profile. This translates into some 15,000 additional graduates. As Scenario 2b indicates, it is likely that the difference in graduate output would widen as the intake increased. Thus Scenario 1 would enable many thousands of students to realise their potential and their investment in higher education every year, in contrast with the loss of opportunity and money they experience in the status quo.

In summary, this analysis indicates that in the new structure the student body would on average have the same outlay for higher education as is the case now. It is likely that some students, expected to be relatively few, would have a higher outlay, for reasons such as incorrect placement; however, a greater number would pay less or, more importantly, achieve a qualification rather than drop out and lose their investment.

The message of this analysis will need to be strongly communicated to the public if the negative perceptions that can attach to the idea of an extra formal year of study are to be effectively countered.

8.5 Academic staffing considerations

The academic staffing implications of the proposed flexible curriculum structure require analysis as a key element of implementation. There are two main issues to consider:

- the extent to which there will be a need for forms of teaching that are different from what is currently in place, and how this might have an impact on existing staffing
- whether there would be an adverse effect on student-staff ratios and hence on academic teaching loads.

Forms of teaching

As different institutional, faculty and disciplinary cultures affect academic teaching approaches and the balance between teaching, research and community engagement responsibilities, it is not possible to generalise the likely effect on academic staff of introducing a flexible curriculum structure. However, it is clear that meeting the needs of the majority of the intake will require a greater emphasis on entry-level teaching and course design that is geared to bridging the articulation gap and enabling students to develop sound academic foundations, in terms of subject knowledge and relevant academic skills.

For example, analysis of the articulation gap indicates a need for a more explicit focus on the development of academic literacies than has traditionally been the case. Different approaches to this would have different implications for staffing. Separate courses in, say, language development

or numeracy are normally offered by specialists in these areas, while integrating the development of the relevant literacies into core disciplinary courses calls for collaboration between such staff and disciplinary specialists.

In summary, growth in educational expertise to implement the flexible curriculum can be achieved in two complementary ways: building knowledge of teaching and learning among academic staff through professional development opportunities; and increasing the proportion of educational specialists in the institutions. The benefits to be gained for academic staff include teaching courses with less diversity in preparedness in the class and with fewer repeating students.

Growing educational expertise will take time, so it is recognised that, in the shorter term, introducing a new curriculum structure will call for an unusual concentration on curriculum and course design work in the early years. How this work can be facilitated and supported is discussed in Chapter 9.

Each institution will need to address the issue of ensuring appropriate staff capacity in its own way, but the state can play a key role in facilitating positive change through its steering mechanisms of funding and quality assurance (DoE 1997). In particular, the state has a responsibility to enable the sector to fulfil its obligations by making provision for adequate staffing resources. This is discussed below.

Academic staff resources and workloads

The second major question posed in this section is whether the proposed new curriculum structure would have an adverse effect on student-staff ratios and hence on academic teaching loads. There may well be an immediate perception that the proposed new norm of an additional year of formal time would mean a proportionately greater total teaching load across the sector. This is not the case, and this section quantifies and analyses the implications of the new structure for the full-time equivalent (FTE) numbers of academic staff required to maintain current student-staff ratios, and how this would be funded. The projections are also compared with those of the other scenarios. The study is confined to academic staffing.

Sheppard (2013: 35-40) sets out the methodology for calculating the FTE academic staff required for the various scenarios, and shows the numbers and the associated direct costs. Essentially, the approach is as follows: (a) the actual status quo FTE staff numbers, student-staff FTE ratios and average FTE staff cost, based on 2010 HEMIS data, are used as the basis for the projections; (b) these ratios are applied to the enrolment projections of the different scenarios to establish comparative numbers and costs for a single cohort, to enable analysis; and (c) more favourable ratios are similarly applied to establish comparative costs, as a basis for assessing the feasibility of improvement, as discussed later. An 8% annual inflation adjustment is applied to the cost projections.

Provision for academic staffing on the basis of current student-staff ratios

Table 15 summarises the findings for one cohort (comprising all three qualification types) of each of the scenarios, drawn from Tables 15a and 16a of Sheppard (2013). It also shows the additional subsidy that would be generated by the different scenarios, from which additional staffing costs would have to be funded.

Table 15: FTE academic staff numbers and funding required for one cohort in order to maintain 2010 student-staff ratios, by scenario

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
FTE staff required	10,288	11,687	13,110	14,390
Staff cost	R4.775 bn	R5.464 bn	R6.083 bn	R6.713 bn
FTE staff increase wrt status quo	-	1,399	2,822	4,102
Cost increase wrt status quo	-	R0.689 bn	R1.308 bn	R1.938 bn
% Increase wrt status quo	-	14%	27%	41%
Additional subsidy generated	-	R1.25 bn	R2.17 bn	R3.07 bn

Key points arising from these data are as follows:

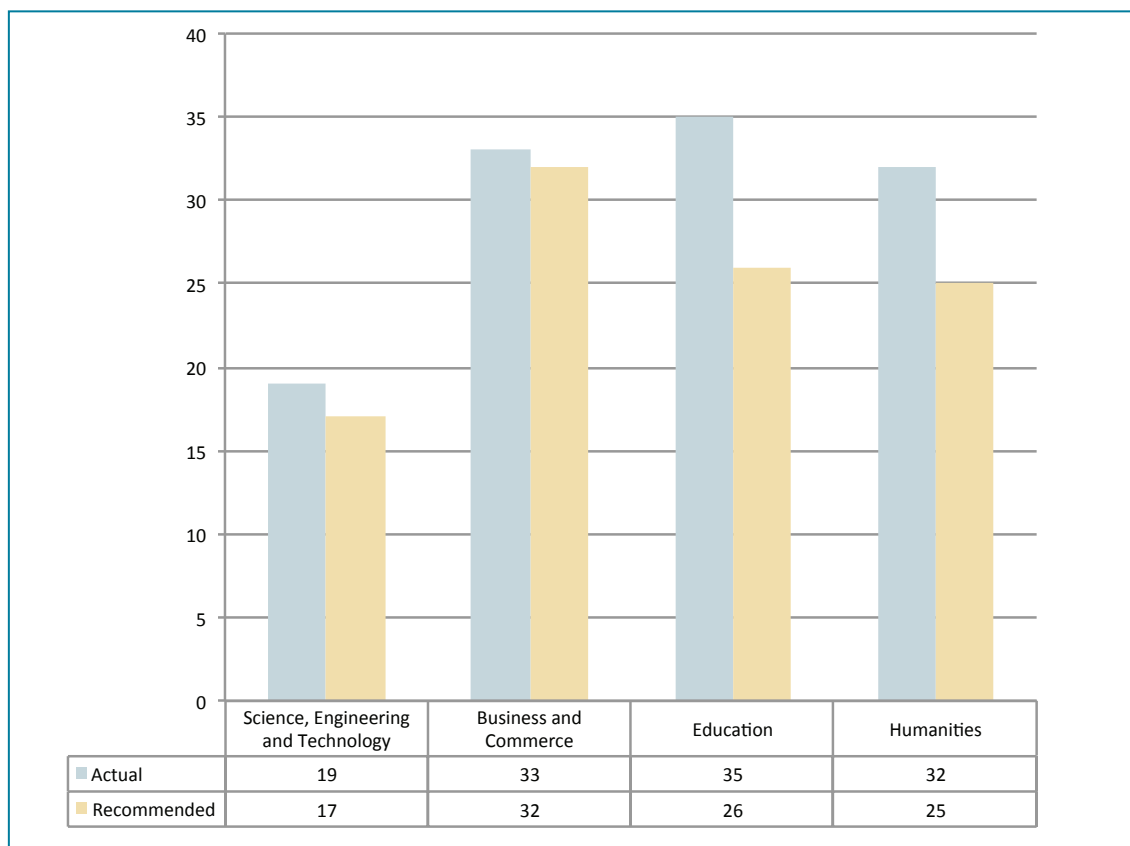
- In line with the patterns established in this chapter, in Scenario 1 the increase in the number and cost of additional academic staff members required to maintain current student-staff ratios is a relatively modest 14%. In contrast, the increases for Scenarios 2a and 2b would nearly double and treble this percentage respectively.
- The additional subsidy that would be generated by each scenario (in terms of current norms) is provided for illustrative purposes as it would have to cover a range of costs besides academic staffing. However, since a high proportion of the subsidy is spent on staffing, and since academic staffing should be a priority call on the subsidy, there should – barring new constraints or unfavourable changes in the funding formula – be sufficient additional subsidy to enable current student-staff ratios and teaching loads to be maintained in all scenarios.
- The key proviso, however, is that the additional subsidy is in fact made available. The growth commitments in the Green Paper and the National Development Plan will require considerable additional funding, but Scenarios 2a and 2b will make substantially higher demands on the fiscus than Scenario 1 (more than twice as much). The greater the pressure on the fiscus, the more probable it is that the full amounts that would be generated on current norms would not be affordable, and this would in turn impact negatively on staffing levels and student-staff ratios. It would also tend to accelerate the process of casualisation of academic staff, which runs counter to the need for professionalisation. In contrast, it is reasonable to assume that the more efficiently the sector uses its resources – particularly in terms of graduate output – the better the case will be for increasing state investment.

Costs of improving academic staffing provision

According to HEMIS data, in the period 2000-2010 student enrolment grew by 52% but the increase in FTE academic staffing for the same period was 21%. There is thus a case for staffing levels to be improved.

In a recent survey conducted by the DHET for the higher education funding review, universities were requested to propose ideal student-staff FTE ratios for the four major fields of study. The actual 2010 student-staff FTE ratios and the average of the ratios recommended by the higher education institutions are shown in Figure 13.

Figure 13: Actual and proposed student-staff FTE ratios per major field of study for 2010



The number of academic staff required to achieve the recommended ratios for one cohort, together with the costs, are summarised in Table 16, which draws on Tables 15b, 16b and 17 in Sheppard (2013). It should be noted that the projections are based on average ratios across the sector.⁴⁸

Table 16: FTE academic staff numbers and funding required for one cohort in order to achieve student-staff ratios recommended by the universities, by scenario

	Status quo	Scenario 1	Scenario 2a	Scenario 2b
FTE staff required	11,870	13,315	15,128	16,642
Staff cost	R5.508 bn	R6.220 bn	R7.018 bn	R7.764 bn
FTE staff increase wrt 2010 status quo	1,582	3,027	4,840	6,354
Cost increase wrt 2010 status quo	R0.733 bn	R1.445 bn	R2.243 bn	R2.989 bn
% increase wrt 2010 status quo	15%	30%	47%	63%
Additional subsidy generated	-	R1.25 bn	R2.17 bn	R3.07 bn

⁴⁸ Since some institutions have student-staff ratios that are more favourable than the average and would not be expected to raise them, the cost of ensuring that every institution achieved at least the recommended ratios would be somewhat higher than is shown in the projections. Nevertheless, the average gives a fair picture of the magnitude of the numbers involved and allows for direct comparison between the scenarios.

Key points are as follows:

- To achieve the recommended student-staff ratios for a full cohort in current circumstances – i.e. without enrolment growth or change in curriculum structure – would require an additional R733 million over the period.
- To achieve the recommended ratios as well as graduate growth through any of the change scenarios would be significantly more costly. The impact of increasing the academic staff complement on the effectiveness of teaching and graduate output is not simple to assess, and would depend on the educational capacity of the additional staff employed. For example, if the additional staffing did not serve to address the articulation gap, the beneficial effect would be mainly on those who currently graduate rather than on significantly widening success across the board. Since it is not possible to quantify the impact of improving student-staff ratios, the effect on output figures such as average cost per graduate cannot be projected. However, Table 16 provides accurate projections of the costs of achieving the recommended student-staff ratios in the different change scenarios, and therefore allows for direct comparisons between them.
- Scenario 1 represents the most cost-effective scenario, the additional staffing cost in relation to the current position being R1.445 billion (30%) over one full cohort period, or just over R200 million annually per cohort. The additional amount for Scenario 2a would be 50% higher than for Scenario 1, and for Scenario 2b it would be double.
- Since candidates for academic posts in certain subject areas – particularly professional fields – are scarce, the higher the demand, the less likely it is that enough staff will be recruited. The larger numbers of staff needed in Scenarios 2a and 2b would be a disadvantage of these approaches.
- The additional subsidy generated by the current formula would not be sufficient to meet the costs of the recommended student-staff ratios (even in Scenario 2b, since the subsidy would have to cover a range of costs besides academic staffing), so further Treasury allocations would need to be obtained.

The cost of strengthening academic staffing clearly needs to be weighed against the benefits it could achieve. Generally, the way in which the system has managed with deteriorating student-staff ratios has involved a number of practices that are not conducive to student success or to improving graduate output and outcomes. They include, for example: consolidating course offerings and taking more students into large classes taught on a repeat basis; doing away with tutorial systems or including such large numbers in tutorials that they effectively become large class lectures; and expanding the use of easier-to-mark assessments such as multiple choice or, at best, the writing of paragraphs as opposed to essays. On the positive side, innovative uses of learning materials and technology are coming into play, but the process is slow, owing partly to pressures on staff time and a lack of incentives for educational development.

If greater provision for academic staffing is used to establish a better balance between the main functions of higher education – teaching, research and community engagement – and particularly to facilitate good educational practice and educational expertise, the benefits to the country can be expected to be considerable. There is a clear risk, however, that growing staff numbers could result merely in an uncritical continuation of the structures and practices that have thus far failed to produce the student performance patterns needed for national development and equity.

Improving academic staff numbers should therefore be complementary to, not a substitute for, systemic improvement. In particular, the proposed new curriculum structure is expected to provide an enabling framework that would foster sound teaching approaches – including the appropriate use of technology – and go a long way towards ensuring that staff growth would contribute productively and creatively to student success.

8.6 The Higher Education Qualifications Sub-Framework

The Higher Education Qualifications Framework (HEQF) has, since the beginning of 2009, provided the parameters within which higher education qualifications may be offered. While a review has recently been undertaken, the essential organisation and characteristics of the framework remain unchanged, with the major differences being the inclusion of some additional qualification types and more flexible articulation pathways.

The HEQSF (Higher Education Qualifications Sub-Framework, as the revised framework is now known) sets out the qualification types recognised in higher education together with their main defining features, including purpose and minimum overall credit values. It does not specify maximum credit values, or the expected duration of study of a qualification, although HEQSF credits are related to the notional hours needed to complete a qualification. There is no necessary correlation in the HEQSF between years of study and NQF levels; a Bachelor's degree at Level 7 thus will retain the same purpose, characteristics and outcomes whether it carries 360 credits or 480 credits. A precedent has already been set with the BEd, which, despite being at Level 7, has a minimum credit total of 480 credits, on the assumption that more time is required to master the relevant material than the current norm for a general formative Bachelor's degree. Its level of cognitive difficulty and its learning outcomes are appropriately pegged at Level 7 rather than 8, notwithstanding what 480 credits might suggest.

The proposed four-year general Bachelor's degree can thus already be accommodated in the current HEQSF at Level 7 and 480 credits, and can be distinguished from the current four-year professional Bachelor's, which is pegged at Level 8 in terms of cognitive difficulty. Accommodating the new five-year norm for the latter would require a minor HEQSF adjustment, setting its credit value at 600. Similarly, the diploma, which is currently placed at Level 6 with a minimum of 360 credits, could carry 480 credits and still be pegged at Level 6.

Therefore, in terms of implementation of the new structure, the HEQSF does not contain any barriers that cannot be overcome with minimal revision. The main amendment will be that the minimum total credit value for a degree or a diploma will need to be changed to reflect the new norm of an additional 120 credits, thus 480 or 600 in all, including a maximum of 120 from which students may be exempted, depending on their individual level of preparedness.

8.7 System readiness

There can be little doubt that the problem of poor throughput rates and inefficient use of resources in higher education is of a magnitude that cannot be ignored. Thirty years of alternative access, foundational provision and extended curricula have indicated that while much can be done to

improve the chances of underprepared students achieving their potential, such efforts have hitherto remained small-scale and to a large extent marginal to the overall operations of higher education. While there have been large policy changes in higher education – mergers, new qualification frameworks, a new funding formula and internal restructuring in many cases – that have led to the phenomenon of ‘change fatigue’ among academics, the objective conditions are such that well planned and resourced large-scale curriculum change can be implemented without major disruption of the system.

As argued in this chapter, the proposed new structure outlined as Scenario 1 represents the most efficient and cost-effective approach to substantially improving graduate output and thus to paving the way for responsible system growth, which is a key national policy goal. Moreover, the cost of introducing the new structure has been shown to be moderate and evidently affordable. The national qualification framework issues, as noted above, are relatively easily dealt with. The main outstanding concern, then, is the readiness for curriculum reform within institutions that have undergone many changes.

In this regard, the analysis of implications for academic staffing offered above may alleviate concerns about unfavourable changes in academic staff workloads in the steady state, and illustrate advantages that should arise from a more effective and responsive teaching environment. It is clear, however, that considerable work will need to be undertaken in the institutions during the planning and implementation phases, particularly in the areas of curriculum and course design, placement policy and criteria, and related academic administration. The demands of this work on staff time and expertise, as well as on financial resources, would need to be fully recognised by the relevant national higher education bodies, including the DHET, the CHE, HESA and the professional councils, and effective support systems would need to be put in place for the duration of the implementation, utilising the expertise that is present in the sector. This matter is elaborated in Chapter 9.

All in all, the data and argument in this chapter indicate that, with a carefully managed approach, the introduction of the proposed flexible curriculum structure is not only a necessary systemic response to a systemic problem but also a feasible one.

9. Recommendations on aspects of implementation

Chapter overview

The final chapter of this report outlines some key points relating to issues of implementation of the proposed flexible curriculum structure. Beyond the affordability issues that were considered in the previous chapter, it points to key aspects that will need to be considered as part of an implementation process, but stops short of providing detailed recommendations on how the proposed structure should be introduced as this is beyond the scope of the report.

Since initiating, facilitating and overseeing the new structure would have to be undertaken by central government through the DHET, most of the considerations in this chapter are directed at the national level, focusing on the overall approach to implementation. It is suggested that the best approach would be a sector-wide one, which is underpinned by an appropriate legislative and regulatory context and a supportive transition strategy but within which institutional autonomy is recognised and harnessed to substantially improve educational opportunities for South African students. It further suggests that change on this scale will need to be supported at a national level through a concerted and co-ordinated approach to capacity building with respect to curriculum development. The chapter also includes a brief list of key actions that would need to be taken in the institutions, which is intended to assist with assessing the capacity and resources that would be needed at that level.

The chapter concludes the report noting that, although the introduction of a flexible curriculum structure represents a substantial undertaking, the proposal advanced is an affordable and educationally sound systemic response to the structural problems identified in South African higher education, designed to improve quality, equity and efficiency in graduate output.

9.1 Ensuring responsible implementation in all higher education institutions

As a systemic response, the proposed flexible curriculum structure will be fully effective only if it is implemented sector-wide, and in an accountable manner that ensures that the opportunities it offers for improving student performance are optimally utilised. As indicated throughout the report, the unequivocal purpose of the reform is to facilitate student success and graduation, in the wider national interest.

The incentives for introducing the flexible curriculum structure are strong: improving student performance is in the interests of the institutions as much as of the wider society. In particular, all institutions are committed to student equity and transformation, so a new structure that is specifically and transparently designed to achieve equity of outcomes would contribute directly to meeting these goals. The provision of curriculum paths that allow for realistic assumptions about prior learning substantially reduces the risks of poor completion rates continuing or worsening. Moreover, as the funding analysis in Chapter 8 shows, the improvements are financially feasible.

The Task Team recognises, however, that there is a danger of unintended adverse consequences if the flexible curriculum structure is not introduced in all institutions in a disciplined and responsible way, respecting the central purpose of the reform and its national importance. In particular, exploitation of the flexibility of the structure – for example, for institutional marketing or student recruitment purposes that do not put the students' interests first – would clearly act against the integrity and effectiveness of the system.

It is therefore necessary for regulations to be formulated to ensure that all higher education institutions fully implement the new structure. The private higher education sector must be required to introduce the structure in the same way as the public institutions, just as the HEQSF and similar policies have had to be followed by all.

Mechanisms that can and should be used to ensure the proper use of the flexible curriculum structure include the following:

Programme accreditation: A mass re-accreditation of programmes is not envisaged, as the programmes offered will still have the same purpose, characteristics and exit-level outcomes as at present, and the changes to the curriculum will not constitute more than 50%, with the result that they would not be considered to be new programmes. However, it will be important to ensure that the extended duration of programmes is soundly implemented, that shorter tracks for well-prepared students are coherently designed, and that the placement criteria for admission to a shorter track are rigorous and transparent, as outlined below. The accreditation processes followed by the HEQC of the CHE and other bodies are already sufficiently rigorous to permit adaptation to ensure that the new structure is implemented with integrity and effectiveness, without being unduly onerous on either the institutions or such bodies.

Institutional or programme audits and reviews: In addition to the above, the quality assurance and enhancement mechanisms utilised by the CHE and professional bodies should play a significant role in the implementation of the new structure by, *inter alia*, monitoring student placement and performance as well as curriculum design.

Admissions and placement policy: The only way for students to be admitted to the shorter curriculum pathways envisaged for well-prepared entrants will be through institutions individually granting them exemption for all or some of the first-level courses in the new structure. Effective assessment and placements at this point would be essential for the integrity of the flexible structure. The Higher Education Act of 1997 requires institutions to ensure that their admissions criteria are fair, fit for purpose, transparent and published. By extension, the same must apply to the criteria that institutions use for placements within the flexible curriculum structure. The norm will be that students are admitted to the standard (extended) form of the programme, and institutions will be required to apply strict criteria to permit any departures from this through the exemption procedures. Regulation, at system level and in individual institutions, must thus ensure that the criteria or assessments on which the granting of first-level credit exemption is based are valid, objective and consistent, measuring both knowledge and academic skills. The fundamental test to be applied to placement decisions is what path will maximise the individual student's probability of succeeding in the programme concerned. Rigorous placement policy will be central

to the proper functioning of the flexible structure and is likely to be the most effective means of maintaining its integrity.

Enrolment planning: The annual enrolment planning exercise that the DHET conducts with each institution will also have a significant role to play in discussing, refining and monitoring the implementation and outcomes of the new structure. Bilateral interactions of this kind could provide a basis for sector-wide dissemination of experience and research on progress towards the goals of development and equity.

In the longer term, provided that the exit standards and outcomes of programmes are maintained, the proof of the effectiveness of the flexible curriculum structure will lie in improvement in student learning and completion rates. Successful extended curriculum programmes are already attracting voluntary recruits in increasing numbers as their capacity for improving student performance is demonstrated and becomes more widely known. Similarly, as the flexible curriculum structure becomes established and demonstrates its benefits, it can be expected that it will enjoy increasing student and public support.

9.2 Recognising and harnessing the benefits of institutional autonomy

None of the accountability measures outlined above will infringe on institutional autonomy. Institutions will continue to be free to design their curricula within the nationally-adopted framework, as is the case at present. In fact, a strength of the flexible curriculum structure is the opportunities it gives to institutions to design curricula that suit their particular student profile and institutional mission, without the counter-productive constraint of the current rigid structure and subsidy system that are not sensitive to differentials in students' educational backgrounds. Institutions will also determine how innovative or conservative in curriculum design they can, or wish, to be. While some may adapt their existing core curricula and outcomes to the new structure, others may elect to use the opportunity to undertake more radical re-design, in order to enhance their educational provision and make a distinctive contribution within the sector.

Valuing institutions' disciplinary and local knowledge, contextual awareness and creativity should therefore be a key element of implementation strategy, setting the tone for a positive rather than narrowly compliance-orientated approach. This is closely linked to the matter of capacity building, as discussed in 9.4 below.

9.3 Transition strategies and support

There will clearly be a need for a detailed migration strategy, developed and led at national level, for introducing the new structure. The implementation process should incorporate administrative and financial planning, liaison with and support for the institutions, and liaison with other stakeholders, including student and professional bodies. The DHET has expertise in system-wide planning of this kind and would take the leading role. However, given the scale involved and the need for concentrated effort for a period, the Task Team **recommends** that the DHET, in consultation with the CHE and HESA, consider establishing a dedicated unit to provide leadership, co-ordination and support for the implementation process.

A possible precedent for this, although the work would be of a different nature, is the Merger Unit established by the then Department of Education to facilitate the implementation of the new institutional landscape in the last decade.

It is envisaged that a key aspect of the implementation process will be to provide administrative and temporary financial support for higher education institutions. This would complement the professional curriculum design support outlined below. In relation to funding, although the cohort flow modelling shown in Chapter 8 indicates that there will be some time for institutions to adjust to increasing student retention, the two-year lag between growth in enrolment and the disbursement of teaching input subsidy should be compensated for. There will be additional non-recurrent funding required for the curriculum and course design work to be done in the institutions, and interim funding for pilot projects will be critical. Such financial requirements point to the need for a temporary earmarked transition fund to support the structural change and supports the case for a dedicated unit to manage the process.

9.4 National support for academic staff development and capacity building

Adoption of the flexible curriculum structure can be expected to initiate a period of strong focus on curriculum development, including course design, and to create a need for building capacity in this key academic skill across the system. The main participants in the investigation – the curriculum exemplar working groups as well as the Task Team – have emphasised the need for provision for academic staff development and institutional capacity-building in relation to curriculum development, which is seen as essential to ensure that the introduction of the new structure is a creative process, geared to realising its potential to improve the system.

The Task Team believes that, if the Teaching Development Grant allocation were not redirected into subsidy, its size would provide a key opportunity to mount extensive staff development programmes focused on building educational expertise in curriculum development. This focus would provide a central theme, linked to an authentic need, for the use of the Grant for a specific period. Moreover, since curriculum development is multi-faceted and linked to other key skill areas such as pedagogy and assessment, it would make a significant contribution to raising the level of educational expertise across the sector, with beneficial effects on student success.

In order to provide leadership and co-ordination for this work, as well as helping to ensure equitable access to developmental resources across the sector, the Task Team **recommends** that the DHET, CHE and HESA consider establishing a national unit to take on this role, thereby providing a key form of support for the transition to the flexible curriculum structure for a period of, say, five years.

An appropriate form for such a unit would have to be determined, but it is envisaged that, while it would need a small core of professional staff, it would work primarily through identifying and mobilising existing experts in the institutions, so that these resources could be shared effectively across the sector. It is suggested that its principal responsibilities would be to offer or arrange professional assistance for higher education institutions, in groups or individually, in curriculum and course design and in placement policy and instruments, prioritising what is needed for

implementing the new structure successfully. The mechanisms could range from seminars and workshops to commissioning relevant research and development work, such as further curriculum and course exemplars as well as guideline design principles of the kind developed by the Engineering degree exemplar working group.

In accordance with policy on institutional autonomy, responsibility for curriculum design, within the relevant frameworks established by the state and in some cases the requirements of professional bodies, lies with the higher education institutions. It is therefore suggested that sector organisations, particularly the CHE and HESA, should have the leading role in planning and co-ordinating the delivery of academic staff development opportunities in relation to curriculum design, and that the DHET should facilitate this.

Work in this area will need to be aligned with the administrative and financial support necessary for the implementation phase, as discussed above.

9.5 Timing

Given the nature of the proposed new structure, including the dependence of many curricula on service courses that contribute to a range of programmes in different subject areas, the Task Team believes that gradual phasing-in of the flexible curriculum structure will not be effective, and that the best approach will be to set a specific start-date and stipulate a well-planned lead-in process and period.

Moreover, in view of the pressing need for improving the performance patterns across the system, it is **recommended** that the flexible curriculum structure be introduced as soon as possible. The Task Team is of the view that full implementation should be completed not longer than five years after approval of the new structure.

9.6 Communication strategy

As noted earlier, some constituencies are likely to be sensitive about the perceived consequences of the new structure. In particular, students and their families, bursary sponsors and academic staff members may well initially see the increase in formal time as contrary to their interests. In these circumstances, it will be critical to communicate the shortcomings of the current position and the projected advantages of the new structure effectively and consistently, to these constituencies, other stakeholders, and the wider public through the press.

The Task Team therefore **recommends** that the DHET, in consultation with relevant higher education bodies, consider appropriate means of developing and implementing a comprehensive communication strategy to promote understanding of, and support for, the goals and features of the new structure.

9.7 Institutional responsibilities

A key element of the implementation process at national level will be to develop clear advice or guidelines to assist the institutions with what they will need to do to introduce the new structure. The main areas of institutional responsibility will include:

- Developing placement policy and criteria for granting exemption to students for up to 120 credits within the new curriculum structure, to enable them to register for a set of courses that is appropriate for their level of preparedness. Such placement policy and criteria should be seen as an integral element of admissions policy, and hence subject to the same legal requirements as all admissions policies, in accordance with the Higher Education Act.
- Making available professional development opportunities or other appropriate forms of support for staff in relation to curriculum and course design.
- Designing their curricula in accordance with the new flexible structure, *ab initio* or guided by exemplars. This is expected to require a concentrated effort for a period.
- Managing the transition to the new structure in accordance with DHET guidelines and timelines, with particular reference to 'pipeline' students, i.e. students who are following an existing curriculum when the new structure is introduced.
- Communicating the goals and features of the new structure to their students and staff and other stakeholders at institutional level.
- Strengthening curriculum and career advisory services for their students. This is not specific to implementation of the new structure, but, since the latter will allow students more time to make informed choices about their future, building their capacity to do this will increase the effectiveness of the flexible structure.

Provided that the Task Team's recommendations concerning national support structures are adopted, institutions will have access to considerable professional, administrative and financial assistance. In addition, the analysis of the funding implications in Chapter 8 indicates that institutions may benefit in terms of being able to increase their academic staffing complement through the efficiencies gained. It is also believed that some inter-institutional co-operation can play a significant part in enabling these key tasks to be successfully carried out.

9.8 Conclusion

The Task Team fully acknowledges that implementing the flexible curriculum structure will be a substantial undertaking for the higher education sector as a whole. However, having thoroughly considered the critical shortcomings of the status quo as well as the main alternative approaches to addressing them, the Task Team has concluded that introducing the new structure is a necessary condition for improving the outcomes of higher education, with advantages that justify the effort required.

Improving the effectiveness and efficiency of higher education teaching and learning, for the full range of the student body, carries key benefits for the country as a whole, not only by producing more graduates from the current intake but also by creating a framework for successful growth. The Green Paper and the National Development Plan both stress the importance of the expansion

of higher education for South Africa's development. The Task Team sees the proposed model as the first step, designed to substantially raise the levels of efficiency and success in the sector. The next step will be to widen successful participation, which will be facilitated by the system becoming more responsive and producing more and better graduates to meet developmental needs.

The benefits of the change would be expected to reach a wide range of constituencies:

- the student body, by putting success realistically within range of substantially more people, reducing the differentiating effects of educational and socio-economic background, and creating opportunities to gain educational experiences and qualifications of enhanced value and relevance to the contemporary world;
- the academic community, by enabling teaching to result in more learning and student success, and hence to be more fulfilling;
- the institutions, by creating opportunities to significantly improve their student completion rates and the quality of their programmes, and by allowing for greater comparability of outcomes through differential use of the flexible curriculum structure;
- the education system as a whole, by improving quality and equity in graduate output and hence producing more and stronger candidates for the teaching profession, for staffing FET colleges and other post-school institutions, and for the next generation of academics; and
- the DHET, by providing a basis for it to meet its commitments to successful growth in post-school education, as envisaged in the Green Paper and the National Development Plan.

Most importantly, the country as a whole stands to benefit from the projected improvement of quality and equity in the graduating class, in terms of economic and social development and social cohesion.

Finally, the Task Team believes that this study has shown that implementing the flexible curriculum structure is feasible, and is the most cost-effective and educationally sound of the possible options for necessary systemic reform.

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Appendices

1. Terms of reference
2. Curriculum Exemplars : Reports from the Working Groups
 - 2.1 Bachelor's degree in Engineering – Curriculum Exemplars
 - 2.2 Engineering diploma – Curriculum Exemplars
 - 2.3 Bachelor of Commerce – Curriculum Exemplars
 - 2.4 Bachelor of Science – Curriculum Exemplars
 - 2.5 Humanities and Social Sciences Bachelor's degree – Curriculum Exemplars

1. CHE Undergraduate Curriculum Structure Task Team

Terms of reference

1. Background

- 1.1. In *Education White Paper 3: A Programme for the Transformation of the Higher Education* (DoE: 1997), it is argued that the “articulation gap between the demands of higher education programmes and the preparedness of school leavers for academic study” needs to be addressed if equity of access in the context of redressing past inequalities is to lead to equity of outcomes, i.e. “increased access must not lead to a ‘revolving door’ syndrome for students”, with high failure, dropout and repetition rates.
- 1.2. The White Paper recognises that while in the long-term the improvement in equity of outcomes is dependent on enhancing the quality of schooling, in the short to medium term the articulation gap would have be addressed by higher education institutions through a comprehensive and multi-faceted approach based on a “thorough review of the structure and duration of degree, diploma and certificate programmes” including an assessment of the curriculum in terms of “content, relevance, design and delivery”, and the provision of student support services in relation to careers counseling, financial aid and social and personal skills.
- 1.3. The Council on Higher Education’s (CHE) shape and size task team in its report, *Towards a New Higher Education Landscape: Meeting the Equity, Quality and Social Development Imperatives of South Africa in the 21st Century* (CHE: 2000), proposed the introduction of a “four-year first bachelor’s degree” in response to both addressing the high drop-out rates and changing knowledge needs, including the “desirability and feasibility” of structuring the proposed four-year degree into a “two-year plus two-year” with the possibility of exiting after two years with an associate bachelor’s degree, which it argued may be more relevant for the world of work.
- 1.4. In its response to the CHE in the National Plan for Higher Education (DoE: 2001), the then Ministry of Education supported the CHE’s proposal to investigate the introduction of a four-year undergraduate degree on the ground that “it may provide the framework for addressing a range of objectives such as academic development needs of under-prepared students, the skills requirements of a changing labour market and the enhanced access of workers, mature learners and the disabled to higher education”. And importantly, it stated that any proposals for changing the degree structure “would have to be considered in the light of its implications for the sustainable financing of the higher education system”.
- 1.5. The continued disjuncture between increased access and academic success was highlighted by the Minister of Higher Education and Training at the Higher Education Summit in April 2010. The Minister noted that while the reasons for this are multi-fold

and include inadequate funding, poor student accommodation and poor schooling, institutions would have to adapt their “curriculum and teaching strategies to suit the student population that we have” as “we are not likely to get a radically different type of student anytime soon”. The solution he pointed out would have to be based on “curriculum reform and the expansion of student support programmes”.

- 1.6. It is against this backdrop that the CHE has established a Task Team to investigate the desirability and feasibility of introducing a flexible curriculum framework based on core four-year degrees and diplomas, as a mechanism for both enhancing academic success and for enabling students to grapple with the changing role of knowledge in contributing to social and economic development in the 21st Century.

2. Principles

The investigation must be guided by the principles and goals for the transformation of the higher education system as outlined in the White Paper and the National Plan for Higher Education.

3. Terms of Reference

The Task Team’s investigation must consider the following:

- 3.1 The restructuring of the three main undergraduate qualifications in the Higher Education Qualifications Sub-Framework (HEQSF):
 - 3-year diplomas.
 - 3-year Bachelor degrees.
 - 4-year professional degrees.
- 3.2 The curriculum implications of restructuring in terms of both breadth and depth and entry-level and exit-level standards.
- 3.3 The implications of changing the norm in terms of duration for students whose prior educational background would enable them to complete their studies successfully within the existing undergraduate qualification structure.
- 3.4 The potential for curriculum reform linked to graduate attributes in the context of a changing world - national, regional and international.
- 3.5 The implications of restructuring the undergraduate qualifications for postgraduate qualifications, in particular, the honours degree.
- 3.6 The implications for staffing, particularly in relation to workloads.
- 3.7 The financial implications in terms of affordability and sustainability, including the implications for the National Student Financial Aid Scheme (NSFAS).

- 3.8 The technical implications in relation to the HEQSF, the Higher Education Management Information System (HEMIS) and the funding framework.
- 3.9 The identification of key elements necessary for the successful implementation of any proposed changes to the structure of the undergraduate qualifications.

4. Process

- 4.1 The Task Team may consult with higher education stakeholders and constituencies.
- 4.2 The Task Team may commission specialist studies and draw on the expertise and experience of other specialists as and when required.
- 4.3 The CEO's office will act as the secretariat for the Task Team.
- 4.4 The Task Team is accountable to the CHE through the CEO. The Task Team will complete its investigation and submit its recommendations to the CHE by no later than the end of September 2012.

5. Members

The Task Team comprises:

- Professor Njabulo Ndebele (Chairperson).
- Ms Nasima Badsha.
- Professor Brian Figaji.
- Professor Wieland Gevers.
- Professor Barney Pityana.

2.1 Bachelor's degree in Engineering – curriculum exemplars

Working Group members:

Associate Professor Brandon Collier-Reed (convenor), Dr Howard Pearce, Professor Diane Grayson, Associate Professor Suellen Shay⁴⁹

Introduction

The Bachelor's degree in engineering⁵⁰ is accredited by the Engineering Council of South Africa (ECSA). In designing the curriculum exemplars, we have taken cognisance of ECSA's current exit level outcomes (ECSA 2004) and requirements for the degree, without slavishly adhering to the details of the current degree structure.

In our brief, we were required to design curriculum exemplars that would enable the majority of students to follow a well-designed programme for which they would obtain a BEng degree after five years. The exemplars should also allow a minority of students to enter an accelerated programme and obtain the degree in four years. However, we also see this as an opportunity to suggest ways in which the curriculum could meet the needs of 21st century engineers. The quote below from Purdue University is relevant.

As technological advancements continue to erase our globe's geographical borders and the world population continues to balloon, our students will be asked to solve pressing issues dealing with economic development, poverty, the environment, healthcare, and energy – to name a few. We're revolutionizing our curriculum to prepare our students for their 21st century careers in an increasingly global and fast-changing world.
(<https://engineering.purdue.edu/Engr/Academics>)

In order to align the BEng curriculum exemplars with other degrees, we have used the SAQA norm of 120 credits per year, where 1 credit represents 10 notional hours of study. That means that the BEng degree for those students who follow the mainstream, 5-year programme will comprise 600 credits. The BEng degree for those students who follow the accelerated, 4-year programme will comprise a minimum of 480 credits. For the sake of simplicity, we have allocated all courses except the design courses and the capstone project 12 credits. The number of credits could easily be increased by increasing the credit value per course.

An assumption that underlies the need for two different curriculum exemplars per engineering discipline is that there will be procedures available to effectively identify which students should register for the mainstream, 5-year programme and which students are likely to be successful if they register for an accelerated, 4-year programme.

⁴⁹ Professor Alan Clark from Wits University was nominated to the Working Group by ECSA but was not able to attend meetings or play a full part in the exemplar development process. However, the Working Group records its gratitude to him for reading and commenting on various drafts of the documentation it produced.

⁵⁰ Various known as the BEng, BIng and BSc (Eng). For simplicity we refer to it as the BEng in this document.

Although outside our brief, we wish to mention that there are many non-curricular factors that affect student success. In addition to sound curricula, good teaching and relevant assessment, universities need to provide students with appropriate psycho-social support, such as counselling and career advice, and guidance in accessing financial and other logistical assistance.

Of the many engineering disciplines offered in South Africa, we have chosen to develop curriculum exemplars for two that typically have high enrolments, mechanical and civil engineering.

Outcomes of a BEng degree

The exit level outcomes of a BEng currently stipulated by ECSA are listed below (ECSA 2004).

1. *Problem-solving*
Learning outcome: Demonstrate competence to identify, assess, formulate and solve convergent and divergent engineering problems creatively and innovatively.
2. *Application of scientific and engineering knowledge*
Learning outcome: Demonstrate competence to apply knowledge of mathematics, basic science and engineering sciences from first principles to solve engineering problems.
3. *Engineering design*
Learning outcome: Demonstrate competence to perform creative, procedural and non-procedural design and synthesis of components, systems, engineering works, products or processes.
4. *Investigations, experiments and data analysis*
Learning outcome: Demonstrate competence to design and conduct investigations and experiments.
5. *Engineering methods, skills and tools, including information technology*
Learning outcome: Demonstrate competence to use appropriate engineering methods, skills and tools, including those based on information technology.
6. *Professional and technical communication*
Learning outcome: Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.
7. *Impact of engineering activity*
Learning outcome: Demonstrate critical awareness of the impact of engineering activity on the social, industrial and physical environment.
8. *Individual, team and multidisciplinary working*
Learning outcome: Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments.

9. *Independent learning ability*
Learning outcome: Demonstrate competence to engage in independent learning through well-developed learning skills.
10. *Engineering professionalism*
Learning outcome: Demonstrate critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.

These outcomes are broadly in line with requirements for engineering qualifications elsewhere in the world. Therefore it is reasonable for students in the future to be required to attain them.

An additional outcome we propose that is not adequately captured in the current ECSA outcomes is the ability to integrate technical proficiency and social responsibility. We also believe that more focus is needed on understanding and applying principles of sustainable development, as the practices of the past, climate change, and a burgeoning population are increasingly putting the earth under enormous strain. Therefore we have included sustainable development as a core course.

In addition to performance outcomes, such as those listed above, we believe that an engineering graduate should have certain attributes. In engineering standards documentation, “attributes” is often used to indicate the knowledge, skills and competencies that students are expected to acquire by the time they graduate. However, attributes go beyond demonstrating competence and awareness. We believe that graduate attributes should include, for example, values, attitudes, thinking dispositions (Tishman and Andrade 1995), overarching approaches to professional practice and the development of a set of principles to guide personal actions. For example, Deakin University in Australia states that:

All Deakin programs will encourage students to develop attitudes of intellectual curiosity and motivation for independent thinking, autonomous learning and reflective professional and personal practice, and a commitment to ethical and sustainable practices.
(<http://www.deakin.edu.au/itl/pd/tl-modules/curriculum/grad-attrib/grad-attr-02.php>)

Detailed curriculum design principles

In our discussions we have drawn on research and practice in the areas of systems thinking, higher education, engineering education, teacher education, psychology and cognitive science.

We propose five overarching design principles:

1. *Consider the pool of engineers, not individual students*
South Africa needs to have a pool of engineers with certain skills and knowledge, but the specific knowledge and skills held by each engineer do not need to be identical. On the contrary, there must be some diversity in the skill set and specialised knowledge available within the pool in order to address the need for engineers who are competent to function in different roles. That means that not all engineering students in a particular programme need to take exactly the same courses or follow the same route in order to achieve the expected outcomes.

2. *Distinguish between core subjects and options*

Core subjects are those that are deemed to be essential for all engineering programmes. In order to help us identify core subjects for the mechanical and civil engineering exemplars, we compared the existing programmes of several South African universities and looked for subjects that were part of all (or almost all) programmes. Other subjects are labelled as discretionary (options), but may be required at a particular institution.

3. *Allow choice*

While certain departments may identify other (non-core) subjects as essential, there should be space within the degree programmes for individual students to pursue their interests. This would result in some students pursuing a programme with greater depth in certain areas, while other students may prefer a programme with greater breadth.

4. *Limit students' total load*

Students' "total load" should be limited. In the concept of "total load" we include aspects such as the number of assignments, tests and distinct subjects students must deal with simultaneously. In the exemplars the number of distinct courses students take simultaneously has been kept to no more than five in order to restrict the total load.

5. *Spread out the support for student development*

Student development needs to be done over a period of years, not months. Explicit developmental support needs to be provided at *different times* during the programme, not only at the beginning. More support is needed earlier in the programme than later on.

Before we discuss detailed principles for our curriculum design, let us first look at higher education from a systems perspective. Meadows (2008) identified eight problematic system behaviour "archetypes" that she labels "traps" because, she says, "Blaming, disciplining, firing, twisting policy levers harder, hoping for a more favorable sequence of driving events, tinkering at the margins — these standard responses will not fix structural problems." Four of these traps are relevant to our task:

1. *Drift to low performance*

When performance deteriorates over time it is easy to lower expectations. The solution is to set absolute standards, which may be enhanced as attention is focused on the best in the system instead of the worst.

2. *Shifting the burden to the intervener – addiction*

This occurs when a policy or the action of an individual leads to short-term relief but does not solve the underlying problem. The need for short-term action escalates, but the problem remains. The best solution is to avoid getting into the trap. The next best is to identify the underlying problem and seek long-term restructuring rather than short-term relief.

3. *Rule-beating*

The imposition of rules may lead players in the system to appear to follow them but actually cause distortion of the system. The solution is to create rules that release “creativity not in the direction of beating the rules, but in the direction of achieving the purpose of the rules.”

4. *Seeking the wrong goal*

When the indicators used to measure the attainment of goals are defined inaccurately or incompletely the system may produce unintended or undesirable results. For example, “if the quality of education is measured by performance on standardized tests, the system will produce performance on standardized tests.” This may or may not correlate with quality education. The solution is to take great care in specifying indicators and goals, and not to confuse effort with results.

The goal of engineering education is to produce qualified engineers who have the knowledge, skills and attributes to contribute to the quality of life of the societies in which they work AND who are able to be gainfully employed. We need to guard against merely striving to increase the number of engineering students (trap 4) by lowering standards (trap 1), admitting students who do not have the requisite preparation to cope with the programme (trap 2), or providing courses that on paper meet requirements but in practice are not well designed or taught (trap 3).

In conceptualising the curriculum exemplars we have identified three types of courses:

1. Core courses for all students,
2. Developmental courses for all students except those on an accelerated programme,
3. Discretionary courses to be determined by individual departments and students.

In an engineering degree there are several transition points at which students are expected to be able to think in different ways and deal with different types of knowledge (Donald 2002). These are:

1. From school to university;
2. From basic sciences to engineering sciences;
3. From acquisition of knowledge to design;
4. From knowledge of discrete subjects to analysis of systems and integration of knowledge; and
5. From short, lecturer-led courses to extended student-led projects.

Developmental courses are needed to help students cope with these transitions. They should be designed in such a way that a number of aspects of student growth are explicitly promoted and supported. These aspects could include, for example, behaviours and skills that lead to effective learning, background knowledge, ways of thinking not previously encountered and integration of knowledge and skills.

For developmental courses to fulfil their intended purpose, they will need to be taught by lecturers who have a deep understanding of their subject matter, their students and how to effectively enable their students to master the subject matter and associated skills. Shulman (1986) refers to

three types of content knowledge needed by teachers, namely, subject matter content knowledge, pedagogical content knowledge and curricular knowledge. University lecturers in South Africa rarely undergo any pedagogical training, so their knowledge is often limited to subject matter content knowledge. But pedagogical content knowledge (PCK) is very important for effective teaching of the majority of students. Shulman includes within PCK:

for the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations – in a word, the ways of representing and formulating the subject that make it comprehensible to others.

The presence of well-designed, well-taught developmental courses in the curriculum should reduce the likelihood that engineering education will fall into the “drift to lower performance” trap. It will also help universities adhere to one of the principles for promoting student success identified by Kuh *et al.* (2005: 269), namely, “Student success is promoted by setting and holding students to standards that stretch them to perform at high levels, inside and outside the classroom,” as more students should be enabled to reach higher levels of achievement. However, developmental courses will be resource-intensive, as they are unlikely to be effective unless student groups are reasonably small, of the order of 50 students or fewer in a single class.

Detailed principles that we believe should underpin the curriculum design are listed below.

1. Course credits need to reflect workload accurately (number of hours students are expected to work);
2. The design of courses at all levels needs to be based on the characteristics of students for whom they are intended, including their prior knowledge and skills;
3. Course level (100, 200, etc.) should be designated appropriately. Level is influenced by, for example, familiarity or novelty of the content, prior content knowledge, skills, mathematical or other proficiencies required, integration or application of more than one prior course required, depth, complexity, conceptual and cognitive demand.
4. There is vertical coherence, that is, it is clear which courses must precede or follow others.
5. There is horizontal coherence, that is, it is clear which courses can or should be taken concurrently.
6. Key transition points (in ways of thinking and types of knowledge) need to be identified and supported.
7. A variety of skills, including communication and ICT skills, should be developed within the context of specific, identified content courses rather than in separate courses.
8. Where possible, courses should be designed so that more than one outcome is achieved.
9. Critical pathways should be identified. This includes identifying barriers to progression and providing mechanisms to support progression.
10. Cognitively demanding tasks should be spread out across subjects and semesters.

Commentary on Engineering curriculum exemplars

Total load

One of reasons so many students fail in their first year at university is because the total load is so much higher than they have experienced at high school. At most schools, teachers complete the Grade 12 syllabus at least two months before final examinations begin, and spend the remaining time revising and drilling learners in how to pass the examinations. Students are thus unprepared for the relatively large volume of work and fast pace at university.

In our exemplars we have limited the total load by including no more than five modules in each semester. Although the time management skills of students should improve as they progress, we think that taking too many distinct courses simultaneously is a problem for students in all years. There is a temptation in designing engineering curricula to include a large number of “small” (low-credit) courses, but we feel strongly that it is in the students’ interests to resist this temptation. A possible consequence of limiting total load is that some existing, low-credit courses will need to be combined into new courses. In some cases, this would mean a return to the practices of previous years in which there were fewer, bigger courses that might cover more than one topic.

At levels 200, 300 and 400 we have allocated the design courses 15 credits instead of 12 in order to ensure that the credit value matches the expected time students should spend on these courses.

Flexibility

In the exemplars we have only specified courses that are part of a number of different programmes that we have compared at different institutions. We consider these to be core courses. That leaves room for other courses to be added at either a department’s or a student’s discretion. While some departments will consider certain courses essential for their students, we feel strongly that there should be room for students to be able to choose some of their courses according to their interests. An engineer in a certain discipline needs to have a certain core of knowledge and skills, but within the *pool of engineers* there should be individuals who have specialised knowledge in diverse areas. Therefore some courses that we have labelled “discretionary” should remain unspecified so that students can choose electives, and not only in their final year.

Electives could be both technical and non-technical. The University of Michigan requires students to take the equivalent of between 34 and 56 credits of “general electives” that, “are intended to allow students to explore any dimension of intellectual endeavour that they elect, in both technical (including engineering) and non-technical fields.” They also require the equivalent of approximately 60 credits (at least 11 credits of which must be at or above level 300) that promote “intellectual breadth,” which they describe as follows:

It is important that our students learn about modes of thought and areas of human accomplishment beyond the purely technical. This breadth can be designed by students to provide context to their engineering work by learning about human modes of thought, the structure and history of the human societies that they serve

as engineers, how humans behave and interact, and how humans express their aspirations in the arts, literature and music. This breadth will help students to understand the impact of engineering solutions in a global, economic, environmental and societal context. This breadth makes our students more flexible, creative and better able to work with diverse groups.

We cannot precisely define all of these possibilities for every student so we strive to create a broad intellectual opportunity for students to pursue their interests both beyond and within engineering. Students are encouraged to use these credits in a coherent way to build a foundation of understanding in both the liberal arts and other disciplines that might contribute to their development of creativity or professional foundation. (<http://www.engin.umich.edu/bulletin/uged/reqs.html#breadth>)

In the mechanical engineering exemplar below, technical electives could include, for example, experimental methods or a second course in fluids, while intellectual breadth could be promoted through courses in, for example, psychology, economics or a language.

Transitions

One of the ways that students will be helped to make the first transition, from school to university, will be by limiting the number of modules to four in the first semester of the first year for all students. Most engineering students fail at least one course in the first semester. An important contributing factor is the number of courses they have to take, which results in a total load that is substantially greater than anything students have had to cope with at school. Students will be supported with other transitions through developmental courses.

Developmental courses

In the 5-year, mainstream programme, ten developmental courses have been placed at key points in the curriculum in order to explicitly help students navigate the identified transitions. These courses have been spread out over the whole programme, with a greater concentration in the first semester of the first year. The table below contains a description of each course.

Table 1: Courses in the Engineering degree programme

Code	Name	Description
Maths 101	Foundation Mathematics	Maths 101 is a foundation course. The objectives are to develop conceptual understanding of key mathematical concepts covered in school in algebra, trigonometry and geometry, facility with associated mathematical procedures, and a limited introduction to selected topics from Maths 111. Various academic and ICT skills will be incorporated as appropriate.
Phys 101	Foundation Physics	Phys 101 is a foundation course. The objectives are to develop students' conceptual understanding of key physics concepts, including those that are found in both the school syllabus and in Phys 111, develop a range of scientific reasoning skills, enhance students' problem-solving skills and strengthen their facility with mathematical tools needed in Phys 111. Various academic, communication and ICT skills will be incorporated as appropriate.
Chem 101	Foundation Chemistry	Chem 101 is a foundation course. The objectives are to develop students' conceptual understanding of key chemistry concepts, including those that are found in both the school syllabus and in Chem 111, develop a range of scientific reasoning skills, enhance students' problem-solving skills and strengthen their facility with different representations needed in Chem 111. Various academic, communication and ICT skills will be incorporated as appropriate.
Drawing 101	Introduction to Graphical Communication	Drawing 101 is a preparatory course for Drawing. The objectives are to help students who have not done technical drawing at school learn to translate between 2-D and 3-D, visualise objects in 3-D and represent 3-D objects in 2-D using a variety of views and projections. Freehand sketching, construction techniques using drawing instruments, and computer-aided drawing will be included.
Eng Sci 201	Fundamentals of Engineering Science	Engineering science is simplistically the application of basic science to processes, artefacts and machines which produce a desirable result for industrial society. The first transition from basic science to engineering science involves knowledge of the engineering objects (artefacts), their components and functions and the processes used (often empirically based) to make sense of their interconnected behaviour. The objectives of this introductory preparatory course are to expose students to the foundational aspects of engineering science subjects. These include a quantitative approach in some simple problem settings, conceptual understanding of the core principles that are used throughout the topics, and familiarity with the tools and skills required for success in the course. Much may be achieved through a 'discovery' approach to the material as students will be at a point where they have many more tools and skills available to them than they had in 1 st year.

Code	Name	Description
Maths 202	Mathematics for Engineering	Maths 202 is a preparatory course for the transition from single to multi-variable and vector calculus in the context of engineering. Second-year mathematics brings into play the difficulty of visualizing functions and paths in 3-D space. The course objectives are to smooth the way by introducing the concepts with physical models, computer software that can draw the functions and rotate them, and a systematic approach to drawing the functions on a two dimensional piece of paper in a projection that facilitates visualization. The course will also introduce the contexts in which the graphical representation is required and present the difficult aspects conceptually, before the target course deals with them analytically. The intention is to help students develop the facility to link the visual with the analytical in order to enhance their understanding.
Design 202	Introduction to Engineering Design	Design, as used here, does not primarily imply creative thinking, although aspects of that are essential. Rather, it comprises the process of choosing components and analysing engineering artefacts that will perform the intended function. Design draws on analysis but includes a broad spectrum of skills and knowledge that enable the process. The objective of Design 202 is to introduce students to these skills and to ways of thinking that inspire design. These include the language (jargon) of design, the use of empirical results (usually in tabular form) and formulae, and the role of estimation and approximation. Visual thinking is developed further, with machine drawing becoming a crucial component.
Eng Sci 301	Engineering Science	Eng Sci 201 deals with the fundamentals of engineering science. The objective of Eng Sci 301 is to introduce more advanced techniques of modelling. An example is making the connection between the vector calculus course and fluid dynamics in a way that shows how general results are simplified for specific geometries.
Eng Anal 302	Engineering Analysis	Engineering analysis leads from Eng Sci 301 into the use of those derived results in some of the specific applications that are traditionally covered in these 3 rd level courses: engines, heat pumps, stress in machines/ vehicle components (working out load from real operational conditions). It involves the explicit explanation of the use of more mathematics as applied to engineering; the physical meaning of the mathematics; the way of thinking about the equations and the link between the engineering and the mathematics. It introduces any necessary numerical techniques, the limits of their application and the problems to watch out for. This involves simplifications, approximations and numerical approaches.
Ad Comm 402	Advanced Communication	The objectives of the course are to develop students' ability to access relevant and reliable literature, extract salient information, deal appropriately with opposing viewpoints or contradictory information, and produce extended pieces of cogent, coherent writing.

An additional developmental course, Project Proposal, has been included in the final year for all students in order to help them properly plan their project and receive credit for the time they spend doing this.

There are more developmental courses in the first semester of the first year. This is in line with the recommendation by Kuh *et al.* (2005) to “front load resources to smooth the transition.” They state that,

Institutions that admit students who are not adequately prepared to perform at desired levels are morally and educationally obliged to provide opportunities for them to acquire the requisite knowledge, skills and competencies (Kuh 2005: 314).

Given the importance and the novelty of most of the proposed developmental courses, we suggest that such courses should be developed by national teams of lecturers who have the requisite deep understanding of their subjects, their students and of what makes for effective teaching and learning.

Design courses

Historically, South African mechanical engineering programmes have had a large number of design courses, but these courses have included both subject matter and aspects of the design process. In keeping with international trends, and in the interests of removing barriers to progression, for the mechanical engineering exemplars we have separated out subject matter and design in level 200 and 300 courses into courses named “analysis” in the first semester and “design” in the second semester. Each design course has been allocated 15 credits, while each analysis course has been allocated 12 credits.

We suggest that universities allow students who have obtained an agreed-upon sub-minimum in the analysis course at a certain level to repeat the analysis module in the next semester at the same time as they take the design course in order to facilitate student progression.

Vertical coherence

In the exemplars we have identified several component strands, each of which comprises a sequence of two or more courses. These courses are numbered sequentially and are positioned under one another in the diagram.

Skills

The development of writing and other communication skills and of ICT skills should be integrated into as many courses as possible. However, in the curriculum exemplars certain courses have been labelled with a ‘W’, for writing intensive, and/or an ‘I’ for ICT intensive. In these courses the development of the specified skills will be an explicit component of the syllabus. The three foundation courses in Year 1, Semester 1 of the 5-year programme will also help students develop various academic and life skills, such as effective study methods and time management.

Reducing barriers to progression

Two structural barriers to progression in most programmes are:

1. Courses that are prerequisites for other courses,
2. Courses that are only offered in one semester.

Some courses require students to acquire specific knowledge and skills in preceding courses. However, there are cases in which exposure to the material in a course, without necessarily passing the course, is sufficient for a student to cope with a later course. In these cases, it may be possible to allow students to repeat the course designated as prerequisite and register for the later course simultaneously. This was already suggested in the section on design courses. In the mechanical engineering curriculum exemplars, we believe that placing the design courses in the second semester of Years 3 and 4 will aid progression (provided students can repeat the preceding analysis courses concurrently).

Options for progression will be increased if more courses are offered in both semesters. For courses with small enrolments, this would place too much of a burden on academic staff. However, for the larger-enrolment courses, it is likely that offering them in both semesters will not result in a net increase in staff time when compared to offering them once a year to a class that includes a large number of repeaters. Staff load can also be reduced by rationalising courses that form part of more than one programme, such as thermodynamics or statics, and making them faculty offerings rather than departmental offerings. This could be done not only with first-year courses but also with higher level courses. Discipline-specific applications could be introduced later. This approach would also make it easier for students to change disciplines. In some universities, such as Purdue University and Virginia Tech, all first-year courses are coordinated through a separate department in the College of Engineering.

Another type of barrier to progression exists when courses have very limited or no formative assessment and little feedback is provided to students. This may result in students failing the entire course because they failed a test early on in the course. This should be avoided, by, for example, allocating assessments done earlier in the course less weight than those done later. Ideally, students should also be provided with feedback throughout the course. This requires resources. One possible way of increasing the resources available for marking and tutoring would be to require post-graduate students to do some tutoring. Work-study programmes for senior undergraduates, as part of financial aid packages, could also include tutoring duties for those whose academic performance is good enough.

Another mechanism to aid student progression is to provide limited teaching and re-examination in certain key courses during part of the winter and summer vacations.

Relationship between curriculum exemplars and ECSA requirements

The table below shows the relationship between the credits allocated to the components of the two mechanical engineering curriculum exemplars and the present ECSA requirements. It is included in order to facilitate a comparison of the relative weights of the components in the existing degree programme and the exemplars.

Table 2: Comparison of credits allocated to different knowledge areas in a BEng in Mechanical Engineering by ECSA and in the curriculum exemplars

Knowledge area	ECSA minimum credits	ECSA minimum scaled credits ⁵¹	Exemplar minimum credits (5-year)	Exemplar minimum credits (4-year)
Mathematical Sciences	56	48	72	48
Basic Sciences	56	48	72	48
Engineering Sciences	168	144	216	168
Design and Synthesis	67	57	108	96
Computing and IT ⁵²	17	15	12	12
Complementary Studies	56	48	12	0
Discretionary	140	120	108	108
TOTAL	560	480	600	480

51 Number of credits if the existing BEng were reduced from 560 to 480 credits

52 Some IT will be included in ENG111 and ENG112

Curriculum exemplar for 5-year (mainstream) Mechanical Engineering programme

First Year	Semester 1	Maths 101 (I)	Physics 101 (WI)	Eng 111 (WI)	Chemistry 101 (WI)		
	Semester 2	Maths 111	Physics 111	Eng 112 (WI)	Chemistry 111	Drawing 102	
Second Year	Semester 1	Maths 112	Statics		Eng Sci 201	Drawing	
	Semester 2	Maths 202		Design 202 (W)	Elec Eng	Thermos 1	Programming
Third Year	Semester 1	Maths 211		Component Analysis 211	Disc	Eng Sci 301	
	Semester 2	Maths 212	Dynamics	Component Design 212		Fluids	Eng Analysis 302 (W)
Fourth Year	Semester 1	Disc		Machine Analysis 311		Thermos 2	Disc
	Semester 2	Disc	Vibrations	Machine Design 312		Disc	Adv Com 402
Fifth Year	Semester 1	Sust Eng		System Design 411		Proj Proposal (W)	Disc
	Semester 2		Disc		Capstone		

Developmental
(5-year programme)

Core

Discretionary

Developmental for
all students

I: ICT-intensive, includes development of ICT skills

W: writing-intensive, includes development of writing skills

Curriculum exemplar for 4-year (accelerated) Mechanical Engineering programme

	Semester 1	Maths 111		Physics 111	Eng 111 (WI)	Chemistry 111		
First Year	Semester 2	Maths 112	Statics	Physics 112	Eng 112 (WI)		Drawing	
Second Year	Semester 1	Maths 211		Solids 1	Component Analysis 211	Disc	Programming	
	Semester 2	Maths 212	Dynamics		Component Design 212	Fluids	Thermos 1	
Third Year	Semester 1	Disc		Solids 2	Machine Analysis 311		Thermos 2	Disc
	Semester 2	Disc	Vibrations		Machine Design 312	Disc	Elec Eng	
Fourth Year	Semester 1	Sust Eng	Disc	Disc	System Design 411		Proj Proposal (W)	
	Semester 2			Disc		Capstone 1		Disc

Developmental for all students

Discretionary

Core

I: ICT-intensive, includes development of ICT skills

W: writing-intensive, includes development of writing skills

Curriculum exemplar for 5-year (mainstream) Civil Engineering programme

First Year	Semester 1	Maths 101 (I)	Physics 101 (WI)	Eng 111 (WI)	Chemistry 101 (WI)		
	Semester 2	Maths 111	Physics 111	Eng 112 (WI)	Chemistry 111	Drawing 102	
Second Year	Semester 1	Maths 112	Statics 112		Eng Sci 201	Drawing 111	
	Semester 2	Maths 202	Fluids	Design 202 (W)	Elec Eng		Programming
Third Year	Semester 1	Maths 211	Materials	Analysis and Design 211	Disc	Eng Sci 301	
	Semester 2	Maths 212		Analysis and Design 212		Eng Analysis 301 (W)	Disc
Fourth Year	Semester 1	Disc	Hydraulics	Analysis and Design 311			Disc
	Semester 2	Disc		Analysis and Design 312		Advanced Com 402	Disc
Fifth Year	Semester 1		Disc	Analysis and Design 411	Sust Eng	Proj Proposal (W)	
	Semester 2	Disc			Capstone		Disc

Developmental
(5-year programme)

Core

Discretionary

Developmental for
all students

I: ICT-intensive, includes development of ICT skills

W: writing-intensive, includes development of writing skills

Curriculum exemplar for 4-year (accelerated) Civil Engineering programme

First Year	Semester 1	Maths 111		Physics 111	Eng 111 (WI)	Chem 111		
	Semester 2	Maths 112	Statics 112	Physics 112	Eng 112 (WI)		Drawing 111	
Second Year	Semester 1	Maths 211		GeoScience	Analysis and design 211	Materials	Programming	
	Semester 2	Maths 212	Fluids	Geotech	Analysis and design 212	Data acquisition		
Third Year	Semester 1		Hydrolics	Hydrology	Analysis and design 311		Disc	Disc
	Semester 2	Disc		Transport	Analysis and design 312		Disc	Disc
Fourth Year	Semester 1		Disc	Disc	Analysis and design 411	Proj Proposal (W)	Sust Eng	
	Semester 2		Disc	Disc		Capstone 1		

Core

Discretionary

Developmental for all students

I: ICT-intensive, includes development of ICT skills
W: writing-intensive, includes development of writing skills

Selection, placement and progression

The mainstream degree programme is designed to take five years, assuming students do not fail any courses along the way. Selection mechanisms will be needed to identify students who have the prior knowledge and ability needed to succeed in this programme. Selection tools may include Grade 12 results (currently the National Senior Certificate) and other nationally or locally designed placement tests, such as the National Benchmark Tests (NBT).

Further placement tests for mathematics and physical science may be developed nationally or locally to identify students who have the prior knowledge and ability to pursue an accelerated degree programme. Given the time and skill required to develop valid placement tests, we believe these tests should be developed nationally. In the longer term, it may be possible for students to be placed in a mixture of mainstream and developmental courses, according to their performance in individual placement tests. Students who are allowed to enter the four-year programme but fall behind because they fail one or more modules may be able to join those on the mainstream programme. Whether they merely repeat subjects they fail or also take some developmental modules is open for discussion. Either way, the programme followed by individual students should not entail a total load that is too high.

We suggest that students who fail no more than one developmental course in their first semester of first year may be offered a second chance in that course, such as a supplementary examination preceded by extra tutoring, or a winter school. However, if they fail more than that, they should be excluded. Given the need for technicians, not only engineers, ways should be sought to facilitate transfer of students from BEng to engineering diploma programmes.

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2.2 Engineering diploma – curriculum exemplars

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Introduction: A four-year Engineering diploma

In response to the HEQF (now HEQSF), the Engineering Council of South Africa (ECSA) developed a new suite of engineering qualification standards to fulfil the requirements for the various categories of professional engineering registration. This new suite of engineering qualifications has been developed to replace the existing engineering qualifications that are currently offered. These qualification standards specify the expected competencies and the minimum credits for the various knowledge areas associated with an engineering curriculum. The higher education institutions have the responsibility of designing, planning and implementing the learning, teaching and assessment processes that will fulfil the requirements of these qualification standards.

The Working Group's proposed 4-year diploma takes these new standards as our starting point. For clarification the 'existing' diploma refers to the standards currently in place; this could be described as a 2 + 1 model where students spend two years doing theoretical, classroom-based work followed by a third year in industry. The recurriculation for the HEQSF (noted above) has resulted in a 'new' 3-year diploma which aims to address a number of weaknesses in the existing diploma. These include: a move away from the model of work integrated learning (WIL) in industry in third year to WIL-embedded (in a variety of forms) across the three years, more opportunities for integration through practice across the knowledge areas, more opportunities for breadth through complementary studies. The new 3-year diploma, along with other new Engineering qualifications, will be phased in by 2014. This project has provided an opportunity to further strengthen the diploma by restructuring it over four years. It is our belief that the proposed 4-year diploma will produce the highest quality of outcomes.

The report is divided into 3 sections: In Part A we make explicit some of the 'points of departure' which inform our overall curriculum design. These are likely to be fairly consistent high level principles which will inform all the working groups' proposals. In Part B we specify the design principles for the diploma in Engineering. Crucial to this is the principle of progression across the different knowledge areas towards increasingly complex integrated forms of practice. Part C presents the implementation of these principles in two specific programmes: chemical engineering and mechatronics. The 4-year diploma exemplars, as well as the accelerated 3-year versions, can be found below.

A. Points of departure

In this proposal we wish to depart from notions of ‘mainstream’ curricula and ‘extended learning’ or ‘foundation’ curricula. The proposed 4-year diploma is the ‘mainstream’ qualification; it is not a ‘foundation’ year plus the ‘normal’ 3-year diploma. There is thus an attempt in this model to rid ourselves of the stigma often attached to foundation-type provision where students feel labelled at the outset as ‘underprepared’, or worse, ‘disadvantaged’. This 4-year curriculum acknowledges that the reality in South Africa is that given our schooling system, the majority of students entering into the diploma are ‘underprepared’ and therefore continue to be disadvantaged by a higher education system based on inappropriate assumptions about students’ entry-level preparedness.

At the same time the curriculum needs to be flexible enough to cater for those students who are better-prepared and may be able to finish in less time. Our proposal is for a 480 credit Engineering diploma with a 4-year state subsidy. Better-prepared students can complete in less time, i.e. be accelerated. There are at least two possibilities for acceleration: one is that students are exempted from and credited for Year 1 courses on the basis of NSC and placement test results. Institutions would receive a pro-rata subsidy allocation which is based on an entry subsidy and a completion. Another possibility is the ‘compressed’ route where students complete the same number of credits but compressed in a shorter period of time through summer/winter school offerings. It will be up to universities to determine the most appropriate routes for acceleration. Early warning systems need to be put in place for students who have been accelerated but fail. These must be given an opportunity to enter the first year at any stage up until the end of the first semester.

We have also intentionally not addressed issues of articulation between the diploma and the professional degree. The foundational knowledge requirements of the diploma and the degree are different – the former with its emphasis on integration and application, the latter with its emphasis on the basic sciences. This means that developing systemic articulation pathways between the two qualifications will be a significant curriculum challenge. We believe that this matter should be institution-dependent and dealt with on a case by case basis.

Re-capping the key high-level design principles informing the proposed 4-year diploma:

- The key principle informing the model is that curricula need to cater for the appropriate entry levels of preparedness of the majority of the students.
- The exit level standard of the proposed 4-year diploma is level 6 and must meet all the prescribed ECSA exit level outcomes for the diploma. We believe that the proposed curriculum will significantly exceed the minimum expected outcomes.
- The curriculum must have some degree of flexibility to enable acceleration.
- Acceleration through exemption will require selection and placement mechanisms at entry level. This has significant national resource implications, e.g. the design of placement tests is a crucial area of research and development for the implementation of the CHE Task Team’s proposal for the introduction of a flexible curriculum.

B. Curriculum design principles for the Engineering diploma

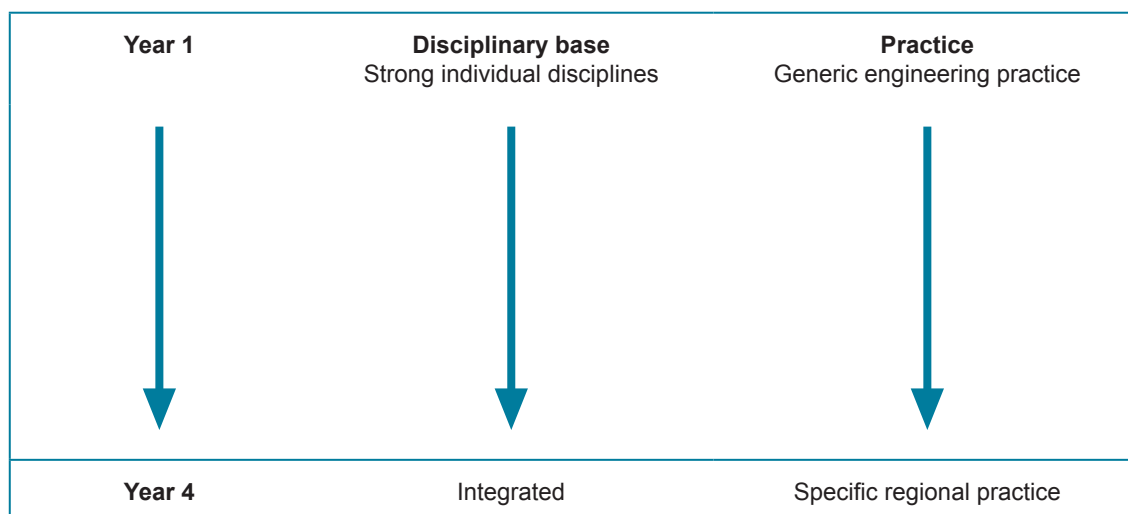
- The proposed learning programme consists of a coherent assembly of knowledge areas. The knowledge areas associated with engineering practice (as specified in the engineering qualification standard) include: mathematical sciences, natural sciences, engineering sciences, engineering design, computing and IT, and relevant complementary studies. Table 1 shows how the minimum credit requirements are distributed over 480 credits and the credit allocation in the two programmes selected.

Table 1: Typical knowledge profile for the Engineering diploma programmes

Knowledge Area	ECSA Standard Minimum Credit Required (360)	Minimum Knowledge Area Distribution for 480 credits	4- year Programme Credits (Mechatronics)	4-year Programme Credits (Chemical Engineering)
Mathematical Sciences	35	49	57	60
Natural Sciences	28	35	60	60
Engineering Sciences	126	168	175	168
Engineering Design	28	42	53	96
Computing and IT	21	28	54	36
Complementary Studies	14	21	51	60
Work-integrated learning	30	37	(integrated above)	
Reallocation	78	100	-	-
TOTAL CREDITS	360	480	480	480

- The curriculum is designed in such a way as to ensure a progressive and scaffolded combination of the key knowledge types in specific subject areas, in such a way as to deepen and extend the preceding knowledge, while adding a new element.
- At each level (semester/year) there will be “integrative active learning activities” or project subjects intended to develop a range of skills and an integration of different knowledge areas in the context of progressively more challenging problems, projects, and standards for performance.
- The exit-level learning outcomes guide the curriculum content as well as pedagogical and assessment decisions.
- There is an increase in the level of cognitive, affective, and psychomotor complexity from first year to final year to ensure an effective preparation for the real world of professional practice, and lifelong learning, as illustrated in Figure 1.

Figure 1: Progression in the diploma across the different knowledge areas towards increasingly complex integrated forms of practice.



C. Implementation of principles in Chemical Engineering and Mechatronics programmes

1. Diploma in Chemical Engineering

The qualification that is being reviewed is the current three-year diploma in Chemical Engineering. This qualification is the starting point of a professional career path in chemical engineering. The skills, knowledge, values and attitudes reflected in the qualification are building blocks for the development of a competent engineering technician. The qualification emphasises general principles and application or technology transfer. The qualification provides students with a sound knowledge base in the discipline of chemical engineering and the ability to apply their knowledge and skills to particular career or professional contexts, while equipping them to undertake further specialised and intensive learning. This qualification has a strong professional or career focus and holders of this qualification are normally prepared to enter a specific niche in the labour market.

In addition to fulfilling the requirements of the qualification standards, the Working Group took the opportunity to develop a more responsive curriculum that attempts to enhance the students' transition and success in engineering studies.

In addition to the curriculum design principles outlined previously, the following additional curriculum design principles were used to develop a learning programme from the qualification standards:

- Students will have multiple opportunities throughout the programme to explore and develop the various competencies from level of novice to the desired level of competence as the student progresses in the programme. These competencies will be assessed on a continuous basis.

- This programme is grounded in learning activities that will facilitate the development of key cognitive and practical skills (enquiry and analysis, critical and creative thinking, written and oral communication, information literacy, teamwork and problem solving) required of an engineering graduate.

The proposed programme will consist of:

Underpinning mathematics and science

Students' knowledge and understanding of mathematics and science will be of sufficient depth and breadth to underpin their chemical engineering education. It is expected that this underpinning material will be taught in an engineering context and, where appropriate, a chemical engineering context. This learning programme will have the following indicative science and mathematics:

- Natural sciences:* physics, general chemistry, inorganic chemistry, physical chemistry, and organic chemistry
- Mathematical sciences:* calculus, algebra, differential equations, and statistics

Core chemical engineering

The cornerstone of all chemical engineering programmes will include a coherent assembly of fundamental engineering sciences, design and principles and applications, engineering practice and embedded issues of ethics, safety, communication, sustainability, etc. This learning programme will have the following indicative content for the core principles and applications of chemical engineering:

- Engineering sciences:* Mass and energy balances, fluid mechanics, heat and mass transfer, separation science, thermodynamics, and principles of process instrumentation and control.
- Engineering design and synthesis:* In chemical engineering, design and synthesis is the systematic process of conceiving and developing materials, components, systems and processes to serve useful purposes. It requires application of engineering sciences, working under constraints, and taking into account economic, health and safety, social and environmental factors, codes of practice and applicable laws. Courses related to design and synthesis will permeate the learning programme from first year to final year, increasing in degree of complexity and relevant industrial context. A minimum of 70 credits is assigned to this learning activity.
- Engineering practice:* This entails the application of engineering skills, combining theory and experience, together with the use of other relevant knowledge and skills to practical applications. This will be developed through work integrated learning (WIL) components which will be embedded into the chemical engineering design and professional practice courses and the chemical engineering laboratory courses.
- Essential embedded learning:* Students will acquire the knowledge and ability to handle broader implications of work as chemical engineering practitioners. These

include sustainability aspects, safety, health, environmental and other professional issues including ethics. They will also develop general skills that will be of value in a wide range of business situations. These include development of abilities within problem solving, communication, effective working with others, effective use of IT, report writing, information retrieval, presentational skills, project planning, self-learning, awareness of the benefits of continuing professional development etc. This material will be consistently built upon from first year and themes reinforced throughout the programme. This essential embedded learning will also be developed through the engineering design and professional practice courses.

Computing and information technologies:

This will encompass the use of computers, and software to support engineering activity. This will include the use of word processing, development of spread-sheets and simple algorithms, and drawing and application software relevant to chemical engineering.

Complementary studies and general education:

This includes those disciplines outside of engineering sciences, basic sciences and mathematics which are relevant to the practice of engineering. This will include engineering economics, principles of management, impact of technology on society, effective communication; and studies in humanities or social sciences that broaden the student's perspective in the understanding of the world. This will be achieved via prescribed and elective modules. They may be prescribed or elective modules on languages (local and foreign), quantitative reasoning and problem-solving, general ethics and citizenship, industrial psychology, introduction to astrophysics, etc.

The typical modules (content) that may be associated with the learning programme for the Chemical Engineering diploma is shown below. The colour of each module is reflective of the knowledge area that the content is associated with. There is also an indication of what outcome, according to the ECSA qualification standard (see below), is intentionally developed and assessed in the module. The listed outcomes will be achieved through aligned learning and assessment activities.

The arrangement and sequence of the modules will ensure the development of the required science, engineering foundation and general skills in the first year to undertake further studies in chemical engineering.⁵³

⁵³ Each module is colour-coded to reflect the dominant knowledge area, but the modules may contribute to the development of multiple exit level outcomes. In addition, the design modules will integrate and contribute to multiple knowledge areas.

Each year has cornerstone activities (*Chemical Engineering Design and Professional Practice*) which will require the application and integration of the multiple knowledge areas, and engineering and generic skills.

The modules *Chemical Engineering Design and Professional Practice* can be combined into one semester to facilitate the completion of the modules at an industrial site.

Whole qualification standard for Diploma in Engineering: (ECSA, May 2012)

Exit Level Outcomes - summary	
1	Apply engineering principles to systematically diagnose and solve well-defined engineering problems.
2	Apply knowledge of mathematics, natural science and engineering sciences to applied engineering procedures, processes, systems and methodologies to solve well-defined engineering problems.
3	Perform procedural design of well-defined components, systems, works, products or processes to meet desired needs normally within applicable standards, codes of practice and legislation.
4	Conduct investigations of well-defined problems through locating and searching relevant codes and catalogues, conducting standard tests, experiments and measurements.
5	Use appropriate techniques , resources, and modern engineering tools including information technology for the solution of well-defined engineering problems, with an awareness of the limitations, restrictions, premises, assumptions and constraints.
6	Communicate effectively , both orally and in writing within an engineering context.
7	Demonstrate knowledge and understanding of the impact of engineering activity on the society , economy, industrial and physical environment, and address issues by defined procedures.
8	Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member and leader in a technical team and to manage projects.
9	Engage in independent and life-long learning through well-developed learning skills.
10	Understand and commit to professional ethics , responsibilities and norms of engineering technical practice.
11	Demonstrate an understanding of workplace practices to solve engineering problems consistent with academic learning achieved.

Table 2: Proposed structure of the 4-year (mainstream) Chemical Engineering diploma

YEAR	Subjects	Credits	Outcomes intentionally addressed
1	Semester 1 & 2		
	Engineering Mathematics Fundamentals 1	24	1; 2
	Engineering Science Fundamentals 1	24	1; 2
	Engineering and Society 1	24	5; 7; 9; 10
	Engineering Design & Professional Practice 1	24	1; 2; 3; 5; 6; 7; 9; 11
	General and Information Literacy 1	12	6; 9
	Computer Skills & Applications 1	12	1; 2; 5
	Total:120		
2	Semester 3 & 4		
	Engineering Mathematics 2	24	1; 2
	Engineering Chemistry 2	24	1; 2
	Engineering Physics 2	12	1; 2
	Technical Literacy 2	12	6; 9
	Chemical Engineering Fundamentals 1	12	1; 2
	Computer Applications 2	12	1; 2; 5
	Chemical Engineering Design & Professional Practice 2	24	1; 3; 5; 6; 7; 9; 10; 11
	Total:120		
3	Semester 5 & 6		
	Engineering Mathematics 3	12	1; 2
	Chemical Process Industries	12	1; 2
	Transport Processes	12	1; 2
	Computer Applications 3	12	1; 2; 5
	Applied Thermodynamics	12	1; 2
	Chemical Thermodynamics	12	7; 8; 9; 10
	Chemical Engineering Fundamentals 2	12	1; 2
	Chemical Engineering Design & Professional Practice 3	24	1; 2; 3; 5; 6; 7; 9; 10; 11
	Chemical Engineering Laboratory 1	12	4; 5; 6
	Total:120		
4	Semester 7 & 8		
	Process Safety and Occupational Health	12	1; 2; 7; 10
	Unit Operations	12	1; 2
	Multistage Operations	12	1; 2
	Environmental Engineering	12	1; 2; 7
	Particle Technology	12	1; 2
	Process Control	12	1; 2
	Engineering Management 1	12	8; 10
	Chemical Engineering Design & Professional Practice 4	24	1; 2; 3; 5; 6; 7; 8; 9; 10; 11
	Chemical Engineering Laboratory 2	12	4; 5; 6
	Total:120		

Table 3: Exemplar - The delivery scheme for the 4-year (mainstream) Chemical Engineering diploma

Year 1 (120)	1	Introduction to Engineering Mathematics	Engineering and Society	Engineering Science	General Literacy	Engineering Design & Professional Practice	
	2				Computer Skills & Applications 1		
Year 2 (120)	3	Engineering Mathematics 2A	Engineering Chemistry 2A	Engineering Physics 2A	Technical Literacy	Chemical Engineering Design & Professional Practice 1	
	4	Engineering Mathematics 2B	Engineering Chemistry 2B	Chem Eng Fundamentals 1	Computer Applications 2		
Year 3 (120)	5	Engineering Mathematics 3A	Chemical Process Industries	Applied Thermo-dynamics	Chem Eng Fundamentals 2	Chemical Engineering Design & Professional Practice 2	Chemical Engineering Laboratory 1
	6	Computer Applications 3	Transport Processes	Chemical Thermo-dynamics			
Year 4 (120)	7	Unit Operations	Process Safety and Occ Health	Multistage Operations	Engineering Management 1	Chemical Engineering Design & Professional Practice 3	Chemical Engineering Laboratory 2
	8	Process Control	Environmental Engineering	Particle Technology			

Table 4: Proposed structure of the 3-year (accelerated) Chemical Engineering diploma

YEAR	Subjects)	Credits	Outcomes intentionally addressed
1	Semester 1 & 2		
	Engineering and Society	12	5; 7; 9; 10
	Computer Applications 1	12	1; 2; 5
	Engineering Mathematics 1&2	24	1; 2
	Engineering Chemistry 1&2	24	1; 2
	Engineering Physics	12	1; 2
	Technical Literacy	12	6; 9
	Chemical Engineering Design & Professional Practice 1	24	1; 3; 5; 6; 7; 9; 10; 11
		Total:120	
2	Semester 3 & 4		
	Engineering Mathematics 3	12	1; 2
	Chemical Process Industries	12	1; 2
	Transport Processes	12	1; 2
	Computer Applications 2	12	1; 2; 5
	Applied Thermodynamics	12	1; 2
	Chemical Engineering Fundamentals 1 & 2	24	1; 2
	Chemical Engineering Design & Professional Practice 2	24	1; 2; 3; 5; 6; 7; 9; 10; 11
	Chemical Engineering Laboratory 1	12	4; 5; 6
		Total:120	
3	Semester 5 & 6		
	Process Safety and Occupational Health	6	1; 2; 7; 10
	Unit Operations	6	1; 2
	Multistage Operations	12	1; 2
	Environmental Engineering	12	1; 2; 7
	Particle Technology	12	1; 2
	Process Control	12	1; 2
	Chemical Thermodynamics	12	7; 8; 9; 10
	Engineering Management	12	8; 10
	Chemical Engineering Design & Professional Practice 3	24	1; 2; 3; 5; 6; 7; 8; 9; 10; 11
	Chemical Engineering Laboratory 2	12	4; 5; 6
		Total:120	

Table 5: Exemplar: The delivery scheme for the 3-year (accelerated) Chemical Engineering diploma⁵⁴

Year 1 (120)	1	Engineering Mathematics 1	Engineering Chemistry 1	Engineering Physics	Technical Literacy	Chemical Engineering Design & Professional Practice 1	Engineering and Society
	2	Engineering Mathematics 2	Engineering Chemistry 2		Computer Applications 1		
Year 2 (120)	3	Engineering Mathematics 3	Chemical Process Industries	Chem. Eng. Fundamentals 1	Computer Applications 2	Chemical Engineering Design & Professional Practice 2	Chemical Engineering Laboratory 1
	4	Applied Thermodynamics	Transport Processes	Chem. Eng. Fundamentals 2			
Year 3 (120)	5	Unit Operations	Process Safety and Occ. Health	Multistage Operations	Engineering Management	Chemical Engineering Design & Professional Practice 3	Chemical Engineering Laboratory 2
	6	Process Control	Environmental Engineering	Particle Technology	Chemical Thermodynamics		

2. Diploma in Mechatronics Engineering

Mechatronics engineering is a multidisciplinary programme based on the principles underpinning mechanical, electrical, computer and control systems engineering. The disciplinary base is fundamentally mathematical, physical, and engineering sciences, with a specific focus on emerging automation control technologies. This is a dynamic field with new hardware and software making their appearance on the market at a rapid rate. As such, expertise in this area is generally situated outside of higher education, which necessitates close relations and collaboration with industry. Current sites of application cover (but are not limited to) the following types of application/sectors:

Nature of work:

Machine Building
Panel Building
Instrumentation
Telemetry
Systems integration
Prototype development
Process control

Sectors:

Manufacturing
Automotive
Agricultural
Mining
Medical
Food & beverage production

⁵⁴ Given the different purposes of a diploma and a degree as provided for in the HEQSF, they CANNOT share common ground. The notion of acceleration in each qualification is fundamentally different. The 'mathematical, basic, natural and engineering sciences' base of the degree allows for possible acceleration on the basis of good NSC results in precisely those subject areas. The basis for acceleration on the diploma programme would more appropriately be workplace or technical experience, as there is greater emphasis on these aspects in the diploma. We have clearly stated that this is NOT a 'foundation year + 3' curriculum. It is 'an integrated curriculum', simultaneously deepening the disciplinary base and scaffolding practice in context over the four-year programme. The possibility of acceleration would be the case-specific awarding of credits for either higher than required entrance marks in the sciences and/or evidence of technical/vocational experience in the relevant subject/practice areas. The latter is currently the practice for those students entering the system with, for example, ICT-related certification or significant work experience. Acceleration would be at the discretion of the provider, and would need to be fleshed out according to individual programmes.

The programme is designed to introduce and develop a broad range of potential areas of specialisation. However, given the fact that this programme draws on fundamentally different types of knowledge which are acquired and developed in different ways, the following additional curriculum design principles are implemented:

- The necessity of initially establishing a deeper understanding of the different knowledge types independently.
- The progressive and scaffolded combination of the key knowledge types in specific subject areas, in such a way as to deepen and extend the preceding knowledge, while adding a new element.
- The explicit integration of core knowledge and skills in engineering practice is designed as a project subject in each semester. This practice is initially generic to engineering and becomes progressively more specific to potential regional specialisations. The forms of practice are intended to include a range of work integrated learning (WIL) modalities.

The proposed learning programme consists of:

Natural and mathematical sciences

Students' knowledge and understanding of mathematics and science will be of sufficient depth and breadth to underpin their mechatronics engineering education. This learning programme will have the following indicative science and mathematics:

- a) *Natural sciences:* (physics), material science, chemical bonds, electrical theory, dynamics, statics, fluid mechanics, semiconductors, conservation of mass and energy
- b) *Mathematical sciences:* Boolean algebra, binary algebra, vector algebra, calculus, differential equations, number systems, numerical methods, mathematical modelling

Mechatronics engineering sciences

- a) *Structural engineering:* mechanics of materials, stress analysis, theories of failure, dynamic loading
- b) *Power and energy transfer:* pneumatic, hydraulic, mechanical and electrical; generation, distribution, control and actuation
- c) *Control engineering:* programmable controllers, feedback systems, distributed control systems, data communications, control software
- d) *Instrumentation:* digital and analogue sensorics, signal conditioning, amplification and transmission, data acquisition
- e) *Manufacturing and production engineering:* hand tools, machine tools, fabrication and production, computer-integrated manufacturing

Engineering design and synthesis

Mechatronics engineering design and synthesis requires application of natural, mathematical and engineering sciences, in the context of economic, health and safety, social and environmental

factors, codes of practice and applicable laws. Courses related to design and synthesis are scaffolded throughout the learning programme from first year to final year, increasing in degree of complexity and relevant industrial context.

Engineering practice

This entails the application of engineering theory, skills and experience to practical applications in specific contexts. The contexts range from laboratory and subject-specific practical work to the integrated design projects (iii) scaffolded throughout the programme. The range of work integrated learning (WIL) components include: work-directed theoretical learning (WDTL); problem-based learning (PBL); project-based learning (PjBL); workplace learning (WPL). The integrated projects entail aspects of research, analysis, manufacturing, maintenance, and design. The effective functioning in specific contexts is supported by communications and professional practice courses designed to support the development of ECSA exit level outcomes 6 to 11. This includes, but is not limited to: communication, documentation, information management, team work, project management, self-regulated learning, and reflective practice.

Computing and information technologies

In addition to the fundamental role of computing in the control aspect of mechatronics engineering, the programme entails the use of computers and software to support general and professional engineering activity. This will include the use of word processing, spread-sheet, drawing and application software relevant to mechatronics engineering practice.

Complementary studies

The programme is designed to develop a broad range of potential areas of specialisation. A fundamental philosophy of 'situated practice' is encouraged and facilitated through a vast network of industry partnerships from manufacturing to automotive, medical, agricultural, mining, and marine engineering sectors. These partnerships allow for access to relevant technologies, necessary expertise and exposure to the impact of technology on society, health and safety, environmental and green engineering, industrial engineering practices, and global automation trends.

Table 6: Proposed structure of the 4-year (mainstream) Mechatronics diploma

YEAR	Subjects	Credits	Exit Level Outcomes developed
1	Semester 1 & 2		
	Engineering Principles	24	1,2
	Engineering Mathematics	24	2
	Engineering Communications	24	6,7,8,9,10
	Engineering Computing	24	5
	Engineering Practice	24	All
		Total:120	
2	Semester 3 & 4		
	Engineering Mechanics	12	1,2,5
	Electrical Engineering and Electronics I	12	1,2,4,5
	Algebra & Calculus 1	12	2,5
	Computer Programming 1	12	2,4,5
	Engineering Professional Studies	12	1-10
	Mechanics of Materials and Structures	12	1,2,4,5
	Electrical Engineering and Electronics 2	12	1,2,3,4,5,
	Algebra & Calculus 2	12	2,5
	Fluid Power Systems 1	12	1,2,4,5
	Computer Aided Design	12	2,5
		Total:120	
3	Semester 5 & 6		
	Engineering Dynamics	12	1,2,5
	Electrical Engineering and Electronics 3	12	1,2,4,5
	Industrial Control 1	12	1,2,4,5,
	Fluid Power Systems 2	12	1,2,4,5
	Embedded Systems Design	12	1,2,3,4,5,6,7,8,9,10
	Electrical Drives & Actuators	12	1,2,4,5
	Fluid Power Systems 3	12	1,2,4,5
	Industrial Control 2	12	1,2,4,5
	Industrial Instrumentation	12	1,2,4,5,
	Mechatronic System Design	12	All
		Total:120	

YEAR	Subjects	Credits	Exit Level Outcomes developed
4	Semester 7 & 8		
	Process Control	12	1,2,4,5
	Industrial Networking	12	1,2,3,4,5
	Automated Manufacturing	12	1,2,3,4,5
	Engineering Professional Practice 1	12	6,7,8,9,10,11
	<i>Mechatronic Design & Manufacturing Project</i>	12	All
	Specialisation Electives: Manufacturing Systems OR Embedded Systems Systems Integration	24	1,2,3,4,5
	Engineering Professional Practice 2	12	6,7,8,9,10,11
	<i>Mechatronic Industrial Project</i>	24	All
		Total:120 ⁵⁵	

55. 1. The integrative practice/project subjects (indicated in **bold/italics**) are initially situated in non-design courses. However, each project entails exposure to all aspects of the desired exit level outcomes, including access to 'real' sites of practice, such as workshops, laboratories and industrial environments. The projects explicitly develop self-regulated learning and teamwork, research practices and context awareness. The subjects in which these projects are situated indicate the initial focal point of the project itself. The year 3 & 4 projects move towards specialisation in specific situated contexts, entailing the synthesis of core theoretical and applied knowledge, but within diverse industrial and professional contexts.
2. All natural, mathematical and engineering science courses entail exposure to tools and technologies by way of practical and laboratory work.
3. All Mechatronics engineering subjects include revision of and introduction to physics-based principles as well as relevant mathematical methodologies.

Table 7: Exemplar - The delivery scheme for the 4-year (mainstream) Mechatronics diploma

Year 1 (120)	1 & 2	Engineering Principles	Engineering Mathematics	Engineering Computing	Engineering Communications	Engineering Practice
Year 2 (120)	3	Engineering Mechanics	Electrical & Electronics 1	Algebra & Calculus 1	Computer Programming	Engineering Professional Studies
	4	Materials & Structures	Electrical & Electronics 2	Algebra & Calculus 2	Fluid Power Systems 1	Computer Aided Design
Year 3 (120)	5	Engineering Dynamics	Electrical & Electronics 3	Fluid Power Systems 2	Industrial Control 1	Embedded Systems Design
	6	Electrical Drives & Actuators	Fluid Power Systems 3	Industrial Instrumentation	Industrial Control 2	Mechatronic System Design
Year 4 (120)	7	Process Control	Automated Manufacturing	Industrial Networking	Engineering Professional Practice	Mechatronic Design & Manufacturing
	8	Embedded Systems	Systems Integration	Manufacturing Systems	Engineering Professional Practice 2	Mechatronic Industrial Project

Table 8: Proposed structure of the 3-year (accelerated) Mechatronics Engineering diploma

YEAR	Subjects	Credits	Exit Level Outcomes
1	Semester 1 & 2		
	Engineering Mechanics	12	1,2,5
	Electrical Engineering and Electronics I	12	1,2,4,5
	Algebra & Calculus 1	12	2,5
	Computer Programming 1	12	2,4,5
	Engineering Professional Studies	12	1-10
	Mechanics of Materials and Structures	12	1,2,4,5
	Electrical Engineering and Electronics 2	12	1,2,3,4,5,
	Algebra & Calculus 2	12	2,5
	Fluid Power Systems 1	12	1,2,4,5
	Computer Aided Design	12	2,5
	Total:120		
2	Semester 3 & 4		
	Engineering Dynamics	12	1,2,5
	Electrical Engineering and Electronics 3	12	1,2,4,5
	Industrial Control 1	12	1,2,4,5,
	Fluid Power Systems 2	12	1,2,4,5
	Embedded Systems Design	12	1,2,3,4,5,6,7,8,9,10
	Electrical Drives & Actuators	12	1,2,4,5
	Fluid Power Systems 3	12	1,2,4,5
	Industrial Control 2	12	1,2,4,5
	Industrial Instrumentation	12	1,2,4,5,
	Mechatronics System Design	12	All
	Total:120		
3	Semester 5 & 6		
	Process Control	12	1,2,4,5
	Industrial Networking	12	1,2,3,4,5
	Automated Manufacturing	12	1,2,3,4,5
	Engineering Professional Practice 1	12	6,7,8,9,10,11
	Mechatronics Design & Manufacturing Project	12	All
	Specialisation Electives: Manufacturing Systems OR Embedded Systems OR Systems Integration	24	1,2,3,4,5
	Engineering Professional Practice 2	12	6,7,8,9,10,11
	Mechatronics Industrial Project	24	All
	Total:120		

Table 9: Exemplar: The delivery scheme for the 3-year (accelerated) Mechatronics Engineering diploma

Year 1 (120)	1	Engineering Mechanics	Electrical & Electronics 1	Algebra & Calculus 1	Computer Programming	Engineering Professional Studies
	2	Materials & Structures	Electrical & Electronics 2	Algebra & Calculus 2	Fluid Power Systems 1	Computer Aided Design
Year 2 (120)	3	Engineering Dynamics	Electrical & Electronics 3	Fluid Power Systems 2	Industrial Control 1	Embedded Sys Design
	4	Electrical Drives & Actuators	Fluid Power Systems 3	Industrial Control 2	Industrial Instrumentation	Mechatronics Sys Design
Year 3 (120)	5	Process Control	Automated Manufacturing	Industrial Networking	Engineering Professional Practice	Mechatronics Design & Manufacturing
	6	Embedded Systems	Systems Integration	Manufacturing Systems	Engineering Professional Practice 2	Mechatronics Industrial Project

2.3 Bachelor of Commerce – curriculum exemplars

Working Group members:

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Introduction

The aim of this report is to explore the design of a four-year Bachelor of Commerce (BCom) degree programme. It first reviews the current issues and limitations facing the majority of BCom degree offerings in South Africa. It then discusses the role which a four-year time span could play in supporting a more enabling degree structure designed to allow the majority of aspiring commerce graduates to attain the knowledge levels and attributes required by employers and relevant professional bodies. The report argues that higher pass rates and better quality of passes could be achieved as a result of this extended structure.

Current degree offerings

Commercial degrees are underpinned by the core disciplines of accounting, economics and management studies, along with several related disciplines such as finance and investment, in addition to essential supporting disciplines such as mathematics and statistics, information technology, and commercial law. They also encompass specifically-focused business-related qualifications such as actuarial science, and business courses such as marketing. The BCom degree options therefore cater for a wide range of students, both those seeking general commercial employment options, and those seeking qualifications accredited by professional bodies – largely in Accounting.⁵⁷

Professional bodies with accreditation agreements involving the universities include the South African Institute of Chartered Accountants (SAICA), the Chartered Institute of Management Accountants (CIMA), the Association of Chartered Certified Accountants (ACCA), the South African Institute of Professional Accountants (SAIPA) and the Actuarial Society of South Africa. For general BCom degree options the individual universities establish broad outcomes, but there are necessarily fewer specific knowledge requirements in each case. The curriculum design options we suggest (as demonstrated in the exemplars below) will therefore cater for more flexibility and electives in courses where the degree is not an accredited one, whereas the curriculum options for the professionally-orientated programmes require a more structured programme to meet specific accreditation criteria. The graduate attributes required by the accredited programmes are

⁵⁶ The working group members acknowledge the contributions from education and discipline experts in the compilation of this report: J. Kew, T. Minter, T. Grinaker, M. Oliver, J. Rowlands, A.F. Schlechter, L. Lakay, C. Cairney, J. Pym, T. Low, D. Lortan, R. Naidoo, A. Arbee, M. Chokuda, J. Skene

⁵⁷ All appendices to this report are available with the full report at www.che.ac.za. Appendix A illustrates the range of current BCom degree options.

relevant to the general degree options as well; both types of degree programmes therefore can be designed to facilitate the kinds of professional and pervasive skills which employers look for.

Not only is there a range of Commerce programmes but also there is clearly no 'typical' Commerce student. Entrants range from top matriculants seeking entry to Actuarial Science and Bachelor of Business Science degrees with demanding entry requirements, to students seeking entry to historically disadvantaged institutions who may be admitted with a 27 APS score or lower. The latter typically represent the top two-to-five percent of matriculants from their schools with clear potential to succeed academically, but most will be first-generation business students lacking the 'cultural capital' of the 'traditional' students of the past. Their circumstances generally preclude their studying off campus and may involve the need to be employed. This has implications for assumptions about reasonable study hours.

Challenges

Registrations for degrees in commercial fields have grown exponentially in recent years.⁵⁸ Graduation rates are disappointing (DoE 2005). Low pass rates are often driven by poor understanding and application by students, which result in part from problems within the existing three-year degree structure. In addition, lack of coherence within many of the degree options along with poor alignment of their outcomes with desired graduate attributes have led employers to complain that students who qualify with a BCom degree are often not adequately prepared for employment.

Educational research on student learning and progression indicates the following critical points in the current BCom curriculum:

1. *Underprepared students:* The existing schooling system does not prepare students adequately for subject choices in commerce or for the business environment in general. Limited prior knowledge of commerce-related issues, terminology and context result in students struggling to make sense of business and financial concepts. This is more apparent in cases where students are from disadvantaged schools, or have not had prior experience of a commercial environment.

A lack of prior knowledge is partly due to the limited range of commercial subjects offered at school level (accounting, economics and business studies), and the fact that these subjects are often not offered at all due to limited numbers of teaching staff qualified in these subjects. Therefore students enrolling for BCom studies at university seldom make this decision based on past experience in these subjects at school, or on effective career guidance.

Further, most students are lacking in core mathematics abilities and are thus mathematically

⁵⁸ DHET figures show that between 2000 and 2010, while the average yearly increase in enrolments was 4.9%, business/ management enrolments grew by 7.2%. In the same period business/ management students came to represent the highest proportion of all enrolments (31%) outstripping science, engineering and technology which fell to second place (28%).

underprepared to deal with economics, mathematics, statistics and financial mathematics. Academic literacy levels are also low.

Overall, this suggests the urgent need for better articulation between school and university to be taken into consideration in curriculum design.

2. *Increasing content volumes and complexity:* The increased complexity of the global financial world has resulted in the development of new forms of knowledge, together with more legislation to regulate the business world, both in South Africa and internationally. The growth in financial products and markets, corporate governance requirements, commercial and tax legislation, accounting standards, and information systems, has resulted in a substantial increase in volumes of knowledge in the field of commerce. The response has often been curriculum overload with students taking as many as twelve or even fourteen courses within one year.

In this situation, rather than a curriculum overloaded with new facts, it is the provision of adequate support courses, along with development of skills in accessing new knowledge and in grasping its nature and significance (in short the skills involved in 'lifelong learning') that are indicated. This emphasis on skills acquisition cannot be quickly or simply acquired and a new approach to teaching and learning along with the need for an integrated approach to curriculum planning is clearly indicated.

3. *Graduates' lack of appropriate preparation for employment:* Given that South Africa is a developing economy, it is increasingly recognised that the BCom curriculum should include the acquisition of general business acumen including entrepreneurship, job creation and leadership skills. In addition, the dynamic and crisis-ridden nature of international global business in the early 21st century suggests that all business graduates need skills in critical thinking and in ethical awareness. These requirements can be encompassed under the umbrella notion of 'pervasive professional skills' or 'graduate attributes'. Employers in fact expect to have to initiate employees into specific job requirements. It was this reality that has often informed major employers' preferences for recruiting top executives with politics, philosophy and economics degrees which proved their ability to think and operate at a high level rather than those with high levels of industry-specific knowledge.

In 2008 Higher Education South Africa (HESA), in collaboration with the South African Qualifications Authority (SAQA), commissioned a report on 'graduate attributes' which investigated the issue of non-alignment between employer expectations and the skills South African graduates in general are able to offer (HESA 2009). This report is clearly of special relevance to commercial degrees and is referred to extensively below.

The introduction of a more appropriate curriculum would therefore appear to be urgent given the importance of commerce degrees to the economic development of the country as a whole, the need to meet the specific requirements of employers and professional bodies, and the need to provide increasing employment opportunities for individual BCom graduates.

Experience with academic development programmes strongly indicates that appropriate teaching and learning together with more space in the programme to embed essential skills and knowledge

are key to enabling academic success in students who come from disadvantaged schooling (Scott and Yeld 2007: 49). High failure and dropout rates affecting undergraduates as a whole, along with employer complaints, indicate that the need for more appropriate instruction and for more time applies equally to the overwhelming majority of the student body.

Many professional bodies and university faculties are aware of these issues and are re-designing their curricula accordingly. It would therefore appear to be particularly appropriate to move fairly quickly to allow these new offerings to be embedded from the start in a more enabling 4-year time-frame.

Proposed outcomes of a four-year BCom degree: achieving graduate attributes

The nature of commerce degrees, by definition employment-oriented, entails that degree outcomes seek the knowledge, skills and qualities seen by employers and professional bodies as desirable. This section discusses the nature of these 'graduate attributes' along with their implications for new and more appropriate educational approaches which could be embedded within a 4-year undergraduate degree.

Outcomes/graduate attributes

Outcomes of degree courses in commercial disciplines fall into two principal categories:

- Technical and professional knowledge sets
- Broad pervasive skills and competencies

The latter in effect enable the technical knowledge to be appropriately understood and applied in business and professional contexts. These skills cannot therefore be considered apart from the factual knowledge specific to individual disciplines which they encompass.

The HESA 'graduate attribute' study (mentioned above) makes this integration clear. The study worked from the premise of a deep notion of employability as stated by Yorke and Knight (2006: 5) as follows:

Employability is influenced, in the main, by four broad and inter-related components: skilful practices (communication, management of time, self and resources, problem-solving and lifelong learning); deep understandings grounded in a disciplinary base (specialised expertise in a field of knowledge); efficacious beliefs about personal identity and self-worth; and, metacognition (self awareness and the capability to reflect on, in and for action) (HESA 2009: 9).

Several findings from this study are relevant to our curriculum recommendations. For instance, employers were asked to rate the quality and importance of attributes associated with basic skills and understanding. In each case there was a gap between employer expectations and the levels of skill they found in the graduates they employed. The attributes below are listed in descending order with the largest gap in expectations found in the skills listed first.

Skills identified by employers		Level achieved	Level expected	Discrepancy
1.	Ability to find & access information	3.5	5.0	1.45
2.	Written communication skills	3.2	4.5	1.34
3.	Ability to use information	3.4	4.6	1.23
4.	Oral presentation skills	3.1	4.3	1.20
5.	Ability to handle large amounts of information	3.4	4.5	1.17
6.	Technical ability	3.3	4.4	1.08
7.	Numeracy or quantitative literacy	3.5	4.5	1.10
8.	Ability to use new information	3.5	4.5	0.99
9.	Computer literacy	3.6	4.6	0.99
10.	Proficiency in English	3.5	4.4	0.98
11.	Prior exposure to the work	3.0	3.8	0.81
12.	Knowing the organisation	3.1	3.8	0.77

Beyond these basic skills, graduate attributes also involve the expectation that graduates will be able to integrate their understanding and demonstrate the breadth and depth of knowledge that will enable them, inter alia, to:

- Advise clients
- Apply knowledge in realistic work scenarios
- Understand the implications of this knowledge in new contexts
- Apply principles to solve problems
- Identify and draw on appropriate information to build arguments that support their ideas
- Demonstrate critical and analytical thought
- Communicate effectively

They are also expected to demonstrate:

- Ethical awareness
- Attitudes and approaches of self-directed, lifelong learners, which entails engaging actively and interactively in learning processes (Hesketh 2011; UKZN 2012a, 2012b).

Universities' mission statements and programme templates have traditionally set out a range of graduate attributes which closely resemble those which employers seek (Hesketh 2011; UKZN 2012a, 2012b). However, these have tended to be aspirational rather than practical (Barrie 2004). More recently there has been a move to identify these attributes more specifically, to embed them in the curriculum and to require that they are formally assessed, along with the technical knowledge requirements.

An example of a new curriculum structure which embodies both detailed technical knowledge sets and the graduate attributes required to enable these to be professionally applied, is the 'Competency Framework for Entry-level CAs' (CF), the new curriculum to be instituted by the

South African Institute of Chartered Accountants (SAICA) from 2013. Here assessment practices have been adapted in order to assess students' ability to contextualize technical knowledge in real life professional scenarios, thus linking graduate attributes directly into the marking process. This is not new in itself, but the context no longer provides simply a backdrop to the facts and calculations which will be marked. Now skill in understanding that background, critically assessing it, and demonstrating an ability to think strategically and communicate appropriately within it are assessed extensively in the final qualifying exams.⁵⁹

A range of graded scenarios set for projects, assignments, or research projects, along with case studies (real or simulated) can mirror the kinds of professional problems, ethical dilemmas, and decision-making situations students will encounter in business. Working with these can test students' ability to deal appropriately with problems at the same time that they are learning related content knowledge, even from first-year undergraduate level. However, this ability clearly cannot be taught or tested within traditional 'chalk and talk' methods, nor by traditional large-group lectures alone. This curriculum therefore represents a new way of achieving desired outcomes. It involves a shift from a 'knowledge-based' to a 'competency-based' curriculum and this is still relatively new to academics in tertiary education.

Graduate attributes being taught and tested in addition to an already very full knowledge base has understandably been criticized as likely to cause 'syllabus overload' and educationalists accept that a three-year syllabus will be insufficient to achieve the desired outcomes for the great majority of South African students even with the best teaching.

The same applies to a four-year programme which includes an honours year, as in the case of the current Accounting curriculum leading towards a CA (SA) qualification. SAICA has accepted this in relation to those formerly disadvantaged institutions seeking accreditation for their courses. Students supported by SAICA in these institutions are currently required to take a four-year programme which involves the development of mathematical and language skills. While SAICA would not like to see a four-year undergraduate programme permanently replacing the current three-year undergraduate degree, they have officially endorsed this Council on Higher Education (CHE) investigation into a flexible 4-year degree structure accepting that it will be required until such time as the schooling system is able to provide well-prepared students for a three-year degree.

The HESA report found that, despite the gaps identified between what employers seek and what universities provide, these are not intractable. Its recommendations include a much closer relationship between business and universities at all levels and imply the need to embed graduate attributes within curriculum structures. It is also interesting that the study noted with approval the early discussions concerning the introduction of a 4-year degree already taking place in the CHE.

While accrediting bodies are increasingly acknowledging that new educational strategies are needed, it is not their role, nor is it the role of the CHE, to prescribe teaching practices. New developmental courses, new ways of teaching within core courses, new assessment practices,

⁵⁹ Details of Competency Framework pervasive professional skills are set out in Appendix B of the full report, available at www.ch.ac.za

greater awareness of the role of supporting courses and how these should be aligned to enable students to succeed in their core courses, are therefore indicated below as examples only. They will be interpreted and adapted by different universities to suit their individual circumstances.

Exit levels

These would not be affected negatively by the new 4-year structure. Indeed, more enabling structures made possible within a 4-year programme should support greater depth and breadth of knowledge, making the existing exit standards achievable by a greater number of candidates – not only raising pass rates but increasing the overall quality of passes.

Outstanding issues

Universities seeking to realign their curricula are likely to encounter the following issues:

- The tension between research time and the development of teaching and learning
- The difficulty of sparking academics' interest in the most effective teaching and learning strategies required to enable the kinds of student learning now required
- The difficulty of retaining the best academics within commerce faculties when industry salaries are considerably higher, and the consequent temptation for lecturers to focus on private work

While it is beyond our brief to investigate these issues within this report, some implications may be flagged:

- SAICA provides subventions to support academic salaries, and other professional bodies, universities or the government might consider the need for this – along with assurances that private work be kept to the minimum, consistent with promoting useful links with the world of work and without impacting negatively on teaching responsibilities.
- It is increasingly accepted that universities should support a policy of ensuring that all lecturing staff are familiar with relevant aspects of the scholarship of teaching and learning. In addition to this, educators within the professions of law and medicine report considerable curriculum improvements through establishing faculty curriculum offices with an educational post at professorial level. The incumbent has responsibility to provide leadership in, for instance, curriculum design, assessment practices, tutor training, and related educational aspects of the faculty's work in ways which are discipline appropriate (Irby 2000; Johnstone and Vignaendra 2003; Kirkland 2000; Wile and Smith 2000). The funding implications of adopting this more generally would have to be addressed.
- Finally, the need to implement desirable teaching and learning practices goes beyond knowledge of how this can be done, to the issue of resource-intensive implementation strategies, apparently once again beyond the budgets available. Learning needs to be developed within interactive situations and with continuous well-informed feedback. While the numbers of academics available may never be sufficient to provide this directly to all students, well-managed tutorial systems can fill the gap and provide additional advantages, particularly in the form of academic advancement of the

senior students involved as tutors. It is possible to design systems involving small group interactive learning, led by knowledgeable and well trained tutors implementing educationally informed tutorial plans, along with regular formative testing marked by tutors and moderated by academics, all within reasonable budgets.⁶⁰ Undertaking tutoring could be a condition of postgraduate funding support.

Curriculum design principles and critical transition points

In addition to the design challenges in the existing BCom degree structures discussed earlier, the following **critical articulation and transition points** are identified in the current three-year curriculum design, with suggestions for addressing these:

- In BCom degrees, as in other disciplines, the transition from school to university can be a stumbling block. Here increased volumes of work, the demanding nature of the work and the independent responsibility for study impact negatively on pass rates. Well-designed courses in foundation subjects along with appropriate enrichment strategies and a limitation on the number of courses taken can mitigate this.⁶¹
- The articulation gap between final year and the world of work or of further study needs to be addressed. Here capstone courses can address the problem.
- Within the degree structure itself problematic transition points will be found to vary from institution to institution involving different 'gate-keeper' courses. Some institutions identify the transition from Economics 1 to 2, or from Accounting 2 to Accounting 3, as problematic. Others experience points where students repeating courses are either overwhelmed with the accumulated workload or unable to proceed on account of pre-requisite or co-requisite rules. Better vertical and horizontal alignment within a more flexible expanded four-year frame should help to mitigate these.

The 2007 OECD report on the most effective schooling systems worldwide found each of the top ten systems to have three things in common: teachers with strong subject knowledge; high quality instruction; and a focus on every student (McKinsey 2007).⁶²

Taking these principles into account, together with the issues noted above, the **exemplars** below take cognizance of the following **detailed principles** that we believe should underpin a flexible curriculum design:

1. Sufficient challenges should be experienced from the start, but also to be balanced with sufficient time to develop skills.
2. The needs of every student who qualifies for entry to be met (note that this includes the very well-prepared student as well as the least-prepared).

60 See Appendix D of the full report at www.che.ac.za

61 See Appendix C of the full report.

62 While the OECD report focuses on schooling systems rather than tertiary education it acknowledges the relevance of its findings to universities. Clearly the current South African situation in particular demands a sensitivity to supportive educational practices at tertiary level.

3. The design of courses at all levels needs to be based on the characteristics of students for whom they are intended, including their prior knowledge and skills and the incremental development of required competencies and attributes.
4. Outcomes of the degree should be similar for each graduate.
5. Course credits need to accurately reflect workload (number of hours students are expected to work);
6. Key transition points (in ways of thinking and types of knowledge) and critical pathways need to be identified and supported. This includes identifying barriers to progression and providing mechanisms to support progression. Where feasible, consideration should be given to offering a course in both semesters to allow students to repeat a course without overload and without dropping a year.
7. Enrichment courses to be spread and not concentrated in the first year. A variety of skills and competencies should be developed continuously within the context of content courses (noted for instance as 'language-rich' or 'appropriate for computer applications' or for 'the development of ethical awareness') while other skills and competencies require development within separately designed courses (for instance Integrated Business Studies, or capstone courses).
8. Major courses should dominate in the final year but be introduced and developed incrementally from earlier years (note that the capstone course should specifically take graduate attributes forward to a higher level in the context of advanced courses and aid the transition to the world of work or further study).⁶³
9. Disciplines at individual course level (100, 200, etc.) should be designated appropriately. Level is influenced by, for example, familiarity or novelty of the content, prior content knowledge, skills, mathematical or other proficiencies required, integration or application of more than one prior course required, depth, complexity, conceptual and cognitive demand. In practical terms this will allow current three-year programmes to be re-aligned over the four-year period, spreading the content and development of skills more appropriately.
10. Courses should be multi-functional where possible. Courses which are writing-rich, which allow for learning through computer applications, or which involve social/ethical issues to be developed and spread strategically over the four-year curriculum.
11. There should be vertical coherence, that is, it is clear which courses must precede or follow others.
12. There should be horizontal coherence, that is, it is clear which courses can or should be taken concurrently.

63 See Appendix C iv of the full report.

13. Ideally, no course should be seen as purely technical or factual, nor should any operate as a 'stand-alone' course or module. All serve to develop graduate attributes relevant to the business world and to the specific degree and discipline area in a consciously integrated way.
14. Cognitively demanding tasks should be spread out across subjects and semesters.
15. Course loads should be restricted appropriately.
16. Course content and assessment should be designed, where practical, to include various forms of activities, for example essay-writing, group work, peer evaluation and assessment, workshops, discussion groups, basic research, use of computer applications, etc. as different forms of enrichment of course content and learning.

There are several excellent examples of activities in existing Educational Development Programmes at many institutions that enhance the learning experience of students, particularly the underprepared student, and these should be incorporated as far as possible in the new curriculum development programmes.

The design of the 4-year curriculum programme aims to spread the existing course content and knowledge fields over four years. The idea is not to add further courses and content to the existing curriculum, but rather to enable more sustained learning and enrichment opportunities within existing courses and facilitating coherence amongst courses within a specific programme. Cognisance should be taken of the starting point of students, given the standard of the existing schooling system and students' under-preparedness for university studies.

The spreading of a standard BCom programme content is illustrated in **Figure 1**, illustrating the building of knowledge levels over 4 years, reaching the current exit levels. An accelerated option for the well-prepared student at entrance level is illustrated in **Figure 2**, indicating how this option allows for the same content over a shorter time period, provided that a student is well-prepared, able to 'test out' from some of the foundation courses and can maintain excellent performance with a larger workload.

Figure 1: BCom (mainstream) degree allocation between knowledge levels and time

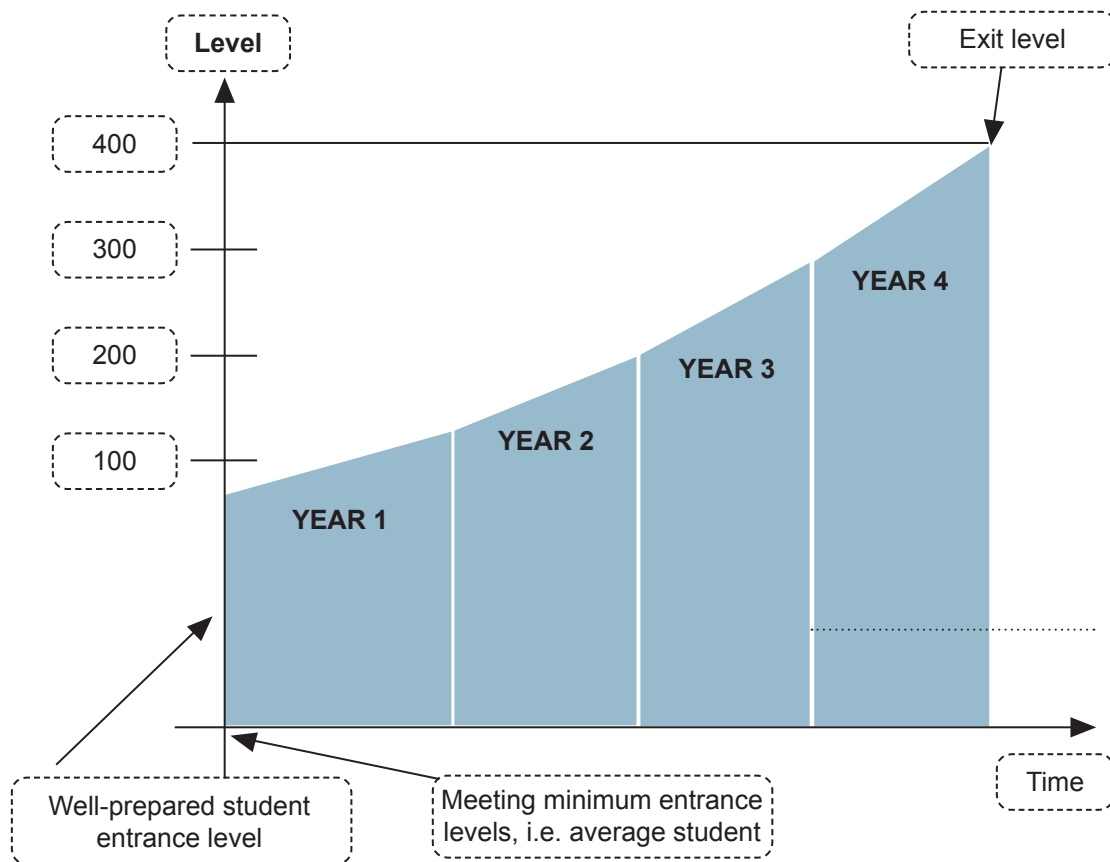
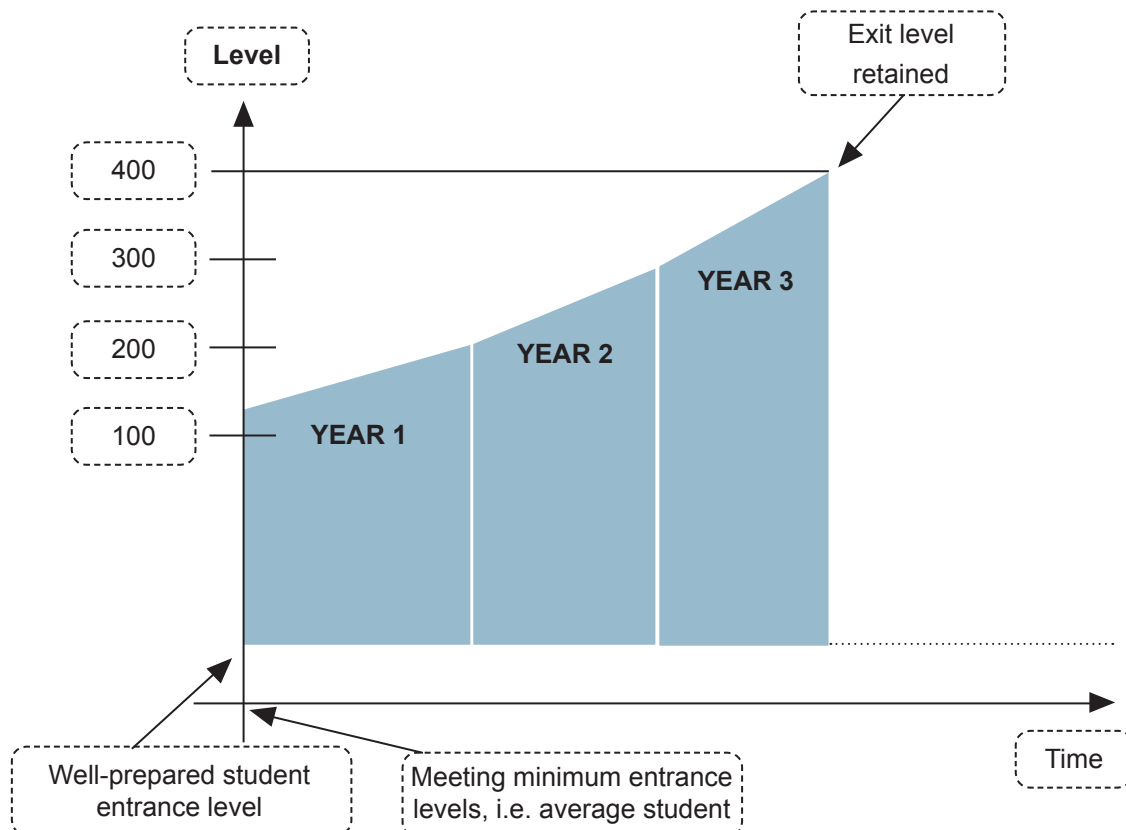


Figure 2: BCom (accelerated) degree allocation between knowledge levels and time



Proposed flexible first-year structure for the four-year curriculum

Entrance requirements:

Entrance assumptions are that students have NSC with university exemption, obtaining at least 4 (D symbol) in 4 subjects, with mathematics. Institutional entrance requirements may vary, and may also include benchmark tests. With the introduction of the 4-year degree, institutions may take into account the following:

- Alternative access schemes would now fall away and, given that more supportive degree structures should now be instituted, a slight reduction in entry requirements could allow the best of those who would formerly have accessed this route to be admitted.
- Any marked lowering of entrance requirements would be counter-productive since universities find that students entering with low Grade 12 passes are not able to cope, and the flooding of institutions with too many applicants must be avoided.

First-year design:

- The HESA report found that ‘employers regarded communicative competence in English, IST skills and an understanding of the world of work as the most important aspects of the basic skills and understanding dimension of graduate attributes’. The first-year should begin to address each of these in a structured way.
- However, a purely ‘bridging’ or ‘academic development’ year is bound to encourage students, funders and universities alike to seek exemption and take the accelerated option if at all possible, reinforcing old stereotypes and missing important learning opportunities required for every student.
- Therefore students should be involved from the outset in serious engagement with their elected majors in order to create a sense of challenge, which would be lacking in a ‘foundation year’.
- The content of undergraduate courses can be judiciously spread over the four years enabling more sustained learning and enrichment opportunities to be embedded in the core courses than is currently possible. First-year core courses should therefore include foundation elements as well as content included in first-year courses in the current three-year degree.
- The maths foundation and computer literacy courses are essential foundations for any student of commerce enabling an appropriate skills base for other major courses.
- The Integrated Business Studies (IBS) first-year course encompasses key language, communication and critical thinking skills to be studied in the context of real world business issues, which establish the foundations of those graduate attributes required by employers and professional bodies.⁶⁴

Specific examples and recommendations are included in the descriptions of the exemplars in the next section.

⁶⁴ See Appendix D of the full report.

Diagrams of specific curriculum options/exemplars of three selected BCom programmes

This section explains and demonstrates the design principles discussed in the previous section, and includes exemplars for 3 different BCom programme options. These exemplars aim to be of illustrative use, and it is imperative that each specific BCom programme curriculum is carefully designed taking into account these design options, but more specifically its major discipline and programme outcomes.

Flexibility and inclusion of enrichment courses:

Our design principles seek to provide an opportunity in the 4-yr degree structure to enable stronger foundations to be laid and necessary skills to be developed at appropriate times throughout the degree without overloading the student while at the same time allowing for enrichment of the degree. The exemplar for the general BCom degree illustrates one way in which this can be achieved. An **alternative** would see two semester courses of wider 'enrichment' options made available to all students including those following accredited Accounting programmes.

The exemplar for the BCom Accounting (CA stream) illustrates one option, based on the opinion that Accounting students following accredited courses have a very full programme which should not be overloaded. While a single enrichment option would be taken in the second semester of first year, the second, third and fourth years comprise only required accounting courses. In this way only four courses are offered per semester, as would be the case with the non-accredited degrees. An **alternative** option would allow the students taking the Accounting degree programme to take, in addition, two semesters of enrichment courses in the second year (at a first-year NQF Level 5). The principle underpinning this approach is that widening the horizons of accounting majors is vital given the significant role they play in business and society and that the addition of two first-year level courses would not amount to syllabus overload. Advocates of this option see additional curriculum design benefits involving articulation and language possibilities, along with increasing the 'pool' of BCom Accounting graduate offerings.⁶⁵

Entrance assumptions:

These exemplars assume admission requirements to the 4-year BCom degree to be the NSC certificate with university exemption, i.e. a 4 (D-symbol) in 4 courses, and pass in mathematics.⁶⁶ Economics and Accounting Grade 12 subjects are not a prerequisite.

⁶⁵ This option is explained further in Appendix C.

⁶⁶ Universities with a high proportion of applicants only able to offer maths literacy may consider admitting these students and providing an appropriately amended maths foundation course or requiring that students pass a maths bridging course before admission.

HEQSF credits:

These exemplars are based on the following Higher Education Qualifications Sub-Framework (HEQSF) credits:

- 1 HEQSF credit represents 10 notional learning hours
- 1 year of full-time undergraduate study currently carries a minimum of 120 credits
- Courses at 100 level are each allocated 12 credits (per semester course), resulting in a current requirement of 5 courses per semester = 120 credits per academic year.
- Courses at 200, 300 and the proposed new 400 (4th-year undergraduate) levels are each allocated 15 credits (per semester course)
- Capstone courses (at 400 level) should include either a mini research project, a written assignment and/or an oral presentation – these should integrate several learning outcomes and encapsulate coherence within each programme at the exit level, equal to 2 courses at 400 level, i.e. 30 credits for the full academic year

The revised 4-year BCom degree should carry at least 480 credits. Institutions may design specific programmes with more credits.

Students who are well-prepared and obtain strong NSC results would be eligible to apply for an accelerated programme option which could include exemption and testing out from foundation maths, Information Systems, Economics and/or Accounting courses for which credits would be awarded (this option may vary between institutions).

Course codes and HEQSF levels:

Courses are labelled in line with the academic year of study, as follows:

- First-year courses: 100 courses – foundation courses at HEQSF level 5
- Second to fourth-year courses: 200, 300 and 400
- 400 courses – exit level at HEQSF level 7
- Capstone courses – integrated courses at HEQSF level 7 (in some cases, depending on the design, learning outcomes, integration and assessment model for such a capstone course – for example the requirement to produce a research paper – such a capstone course may meet the HEQSF level 8 requirement).

Despite the exemplars indicating a course as a first semester (e.g. 301) and second semester (e.g. 302) course, it is recommended that consideration be given to the offering of core and critical courses in both semesters, which will result in a more flexible curriculum for both the 4-year programme and the accelerated option.

This section describes and illustrates the suggested curriculum diagrams and exemplars for the 4-year BCom degree options for the following programmes:

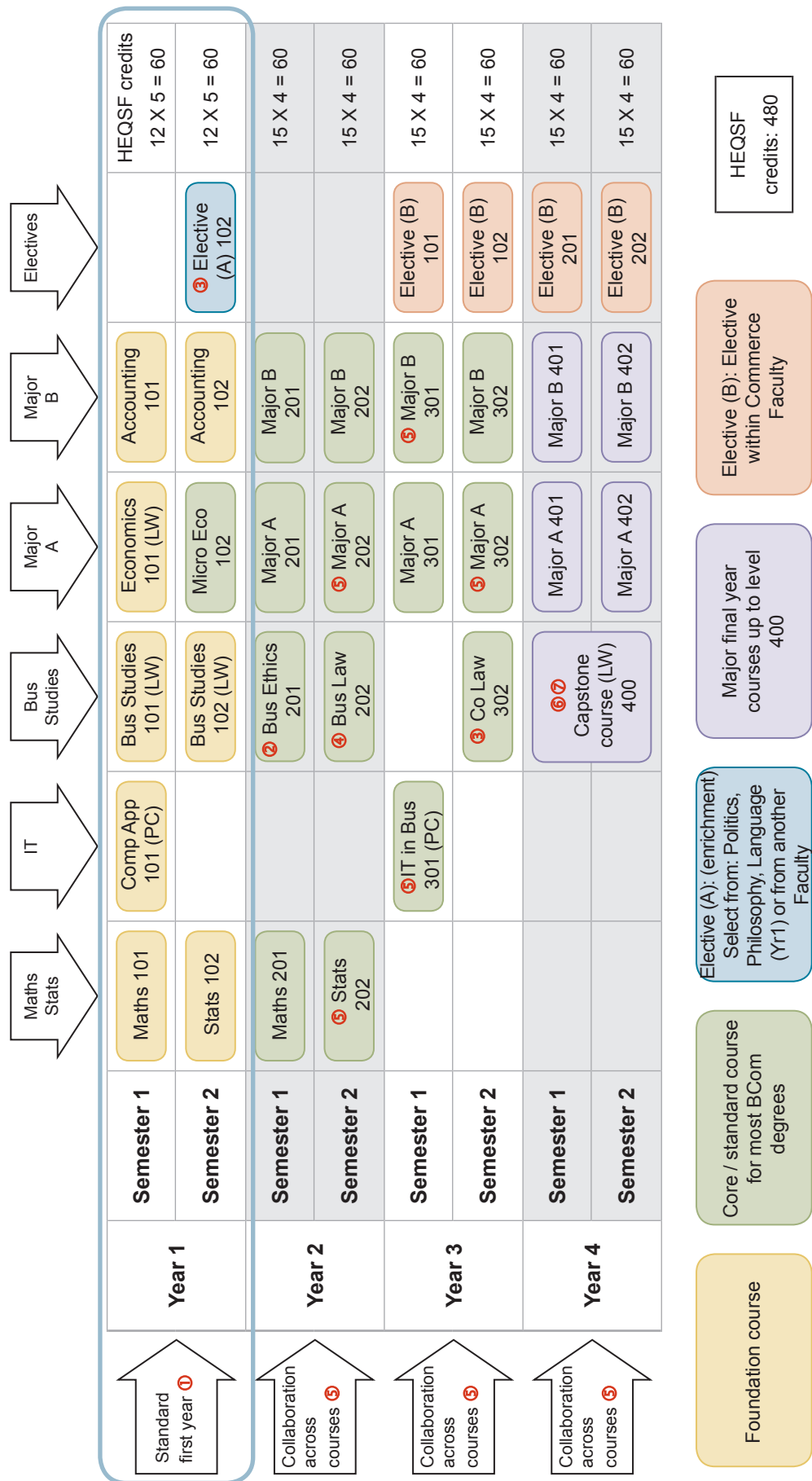
- Figure 3: Curriculum exemplar for 4-year BCom programme curriculum
- Figure 4: Curriculum exemplar for 3-year (accelerated) BCom programme
- Figure 5: Curriculum exemplar for 4-year (mainstream) BCom programme (Accounting CA option)
- Figure 6: Curriculum exemplar for 3-year (accelerated) BCom programme (Accounting CA option)
- Figure 7: Curriculum exemplar for 4-year (mainstream) BCom programme (Finance & Economics)
- Figure 8: Curriculum exemplar for 3-year (accelerated) BCom programme (Finance & Economics)

Description of design considerations for reference to the exemplar below (Figure 3)

	Description of design considerations for reference to the exemplar below (Figure 3)	Detailed descriptions in Appendices
	<p>The more appropriate division of content between years made available by the four-year structure will provide space for course designers to build not only stronger foundations in first year but to shift and stretch content judiciously up and down from current year positions, always with the support of relevant enabling and support courses. Opening spaces for each knowledge area to be supported by contextually relevant courses and assessed in terms of recognised competencies and graduate attributes will allow for an enriched but less-pressurized experience and a less pressurized but academically more stimulating final year. This should include a capstone course designed to prepare students equally for the world of work or for postgraduate studies. The 'capstone course' will develop and test students' skills in integrating their final year courses in ways relevant to the current business environment and involving independent research skills relevant to both professional and postgraduate work. Note that all courses should be taught and assessed in ways which require skills of critical thought, awareness of context and relevant links to other courses. The additional 'integrated business studies', ethics and capstone courses illustrated below reinforce these skills at different points throughout the degree.</p>	
①	<p>First year design: The entrance assumptions are that students have NSC with university exemption, obtaining at least 4 (D symbol) in 4 subjects, with mathematics. Institutional entrance requirements may vary, and may also include benchmark tests.</p> <p>The standard first-year curriculum (5 courses each semester) should involve the following:</p> <ol style="list-style-type: none"> 1. Address the articulation gap in mathematics in a foundation maths course which should enable all students to meet the required standard for university maths (testing out option available). As indicated above, universities with a high proportion of applicants only able to offer maths literacy may consider admitting these students and providing an appropriately amended maths foundation course or requiring that students pass a maths bridging course before admission. 2. Introduce statistics at an introductory level, and make the links between maths and stats explicit. 3. Introduce students to computers and basic computer applications in the foundation course 'Computer Applications' (testing out option available) 4. An integrated and challenging business course (Integrated Business Studies (IBS)) which is language-rich and will enable the development of business acumen, familiarity with the discourse and practical applications in realistic contexts. 5. Two standard BCom courses, normally Economics and Accounting as these are usually offered at 1st year level, forming part of the basic knowledge fields in the business environment. These courses should involve a structured introduction to their skills, assumptions, history and context while at the same time developing an appropriate proportion of the content knowledge currently covered in first year. 6. N.B. 1st year is a notorious gatekeeper year. A careful balance between intellectual challenge and space to develop sound foundational knowledge should be sought. 	Appendix C i
		Appendix C iii

②	An understanding of business ethics (philosophy and the related legal and regulatory requirements) is essential for any business student. A business ethics course should be taken early in the degree (2 nd year is suggested) and developed further in appropriate courses. This should enable a professionally-informed approach to ethics to guide personal behaviour (with respect for instance to plagiarism, work ethic and personal relationships). It should also enable informed ethical analysis in other 'ethics-rich' courses such as auditing, marketing, financial accounting, law, finance, and entrepreneurship.	
③	Once settled into university, the business student should be allowed to select courses in other faculties for their enrichment value. The exemplars illustrate this option in the second semester of 1 st year studies. An alternative option would be to include either two semesters in a chosen elective, or for the really adventurous, two single semesters of different courses if timetables permit. (Employers of business graduates have indicated their support for this widening of the horizons of their employees.) However, for specialised programmes this option may not be feasible, due to the risk of curriculum over-load.	
④	At least two legal courses (support courses offered by Law Faculty) to introduce students to the legal discourse and knowledge of business law, contract law, mercantile law, patents and companies law. Consideration should be given to extend this content to insider trading legislation, consumer protection legislation and whistle blowing legislation, to name a few. It is further recommended that these courses are included at 2 nd and 3 rd year level, in order to provide the basis for the core/major courses in the final year.	
⑤	A practical Computer Application course is essential for students to acquire knowledge of technology as required by business and industry. These may include advanced excel applications, computer accounting packages, Bloomberg data, etc. Careful consideration should be given to the collaboration between such a Computer Application course and other core/major courses, and the integration of these applications in the coursework and assessment requirements of the major courses.	
⑥	A capstone course in the final year should form part of the standard curriculum design for all BCom degrees. This capstone course should include a mini research project, a written assignment and/or a project, as well as oral presentations – these should integrate several learning outcomes and encapsulate coherence within each programme at the exit level, equal to 2 courses at 300 level, i.e. 30 credits.	Appendix C iv
⑦	Embedding the communication and research skills practiced in the first year could involve ensuring that there is at least one course each year which is designated as writing intensive, following the Writing Across the Curriculum (WAC) or Writing in the Disciplines model. The capstone course in the final year would draw on and demonstrate the competences developed in this way	
⑧	Note that the 4-year design should provide spaces for students to repeat courses without overload and without dropping a year e.g.: <ul style="list-style-type: none"> • There is space in the second semester of first year for one first semester module to be repeated • Elective enrichment courses, if failed in second year, can be repeated in third year without overloading the curriculum • Final year courses should be passed more easily given the space for current third-year content to be spread between the new third and fourth years and supported by the capstone course. • Where universities offer summer or winter school options these can perform the double function of allowing repeating students to complete the year successfully and for the benefit of accelerated programme students (note that there should be a minimum mark to allow repeating students access to these courses which will be intensive and should not be seen as providing an easy 'second chance'). 	

Figure 3: Curriculum exemplar for 4-year BCom programme curriculum



	Description of accelerated degree options available for completion of degree in 3, or 3.5 years (refer to Figure 4)
	<p>Cognisance should be given to the fact that some students will be well prepared and will obtain strong passes in the NSC examination, including maths. For these students two options are suggested to allow them to complete the required curriculum in 3 or 3,5 academic years:</p> <ul style="list-style-type: none"> • testing out options at the beginning of first year, and • a heavier workload in 2nd and 3rd academic years. <p>Testing-out options should be at the discretion of the institution but must test rigorously for the learning outcomes to be achieved by the designated courses. Students who meet the testing-out criteria should be given the relevant credits for the course(s). A maximum of four testing out courses are proposed, resulting in a maximum credit allocation of 12 x 4 = 48 credits. The accelerated degree option should still equate to at least the minimum 480 credit points.</p>
<p>1</p> <p>2</p> <p>3</p>	<p>The following testing-out options are proposed at entrance level:</p> <ol style="list-style-type: none"> 1. Students may be given the option to test out of the foundation Maths 101 course by writing an institutional examination in the first week of first year academic enrolment. This examination should be set at the required exit level of the foundation course. This option allows students with sound maths knowledge to proceed to the Stats 101 course immediately. 2. Students with the required information technology knowledge may be given the option to test out of the foundation Computer Applications 101 course, which caters for students with very limited computer knowledge. It is recommended that an external benchmark, for example the International Computer Driving Licence (ICDL) be considered as a demonstration by a student of his/her knowledge of basic computer applications. This option allows students with sound basic computer application knowledge to select one of the proposed electives (for instance Politics, Philosophy or a Language) as an enrichment course in the first semester, completing both enrichment modules in the first year. 3. Students with an average mark of at least 75% in matric (i.e. excellent performance), may be given the option to test out of Economics 101 and Accounting 101 courses, due to the foundation nature of these courses. This testing out option has two motivations: (a) to limit the extent of diversity in the foundation courses by allowing academically strong students to test out of these courses, thereby allowing students with average matric results the time and opportunity to adequately acquire the knowledge, and (b) to facilitate a flexible option for academically strong students to immediately register for Micro Economics and a condensed Accounting course – even though they did not do these subjects at school.
<p>4</p>	<p>Acceleration options through strong performance:</p> <p>A student who demonstrates the ability to perform very well in first year (for example a pass in all courses and an average mark of above 65%), may be given the option to register for additional courses (to a maximum of 6 per semester) in 2nd year and 3rd year, resulting in the completion of the degree in 3 or 3,5 academic years.</p> <p>In cases where institutions offer summer or winter term school options, students with strong results may, in addition, be granted the option to enrol for these. These options would only be available where major courses are in the form of modules, and where the discipline allows for modules to be taken in no specific order, and without pre-requisites.</p>

	Semester 1	Stats 102	Elective (A) 101	Bus Studies 101 (LW)	Micro Eco 102	Accounting 102	Ecos 101 (LW)	Accounting 101	Credits for testing-out: 12 X 4 = 48
Year 1	Semester 1	Stats 102	Elective (A) 101	Bus Studies 101 (LW)	Micro Eco 102	Accounting 102	Ecos 101 (LW)	Accounting 101	HEQSF credits 12 X 5 = 60
	Semester 2	Maths 202		Bus Studies 102 (LW)	Major A 201 ⁴	Major B 201 ⁴	Major A 201 ⁴	Major B 201 ⁴	12 X 1 + 15 X 4 = 72
Year 2	Semester 1	Stats 201		Bus Ethics 201	Major A 202 ⁴	Major B 202 ⁴	Major A 202 ⁴	Major B 202 ⁴	15 X 6 = 90 ⁴
	Semester 2		IT in Bus 302 (PC)	Co Law 302 ⁴	Major A 301 ⁴	Major A 302 ⁴	Major A 301 ⁴	Major B 302	15 X 6 = 90 ⁴
Year 3	Semester 1			Capstone course (LW) 400	Major A 401		Major A 401	Major B 401	15 X 4 = 60
	Semester 2				Major A 402		Major A 402	Major B 402	15 X 4 = 60
Foundation course		Core / standard course for most BCom degrees	Elective (A): (enrichment) Select from: Politics, Philosophy, Language (Yr1) or from another Faculty	Major final year courses up to level 400	Elective (B): Elective within Commerce Faculty	HEQSF credits: 480			

PC: Computer application

Figure 5: Curriculum exemplar for 4-year (mainstream) BCom programme (Accounting CA option)

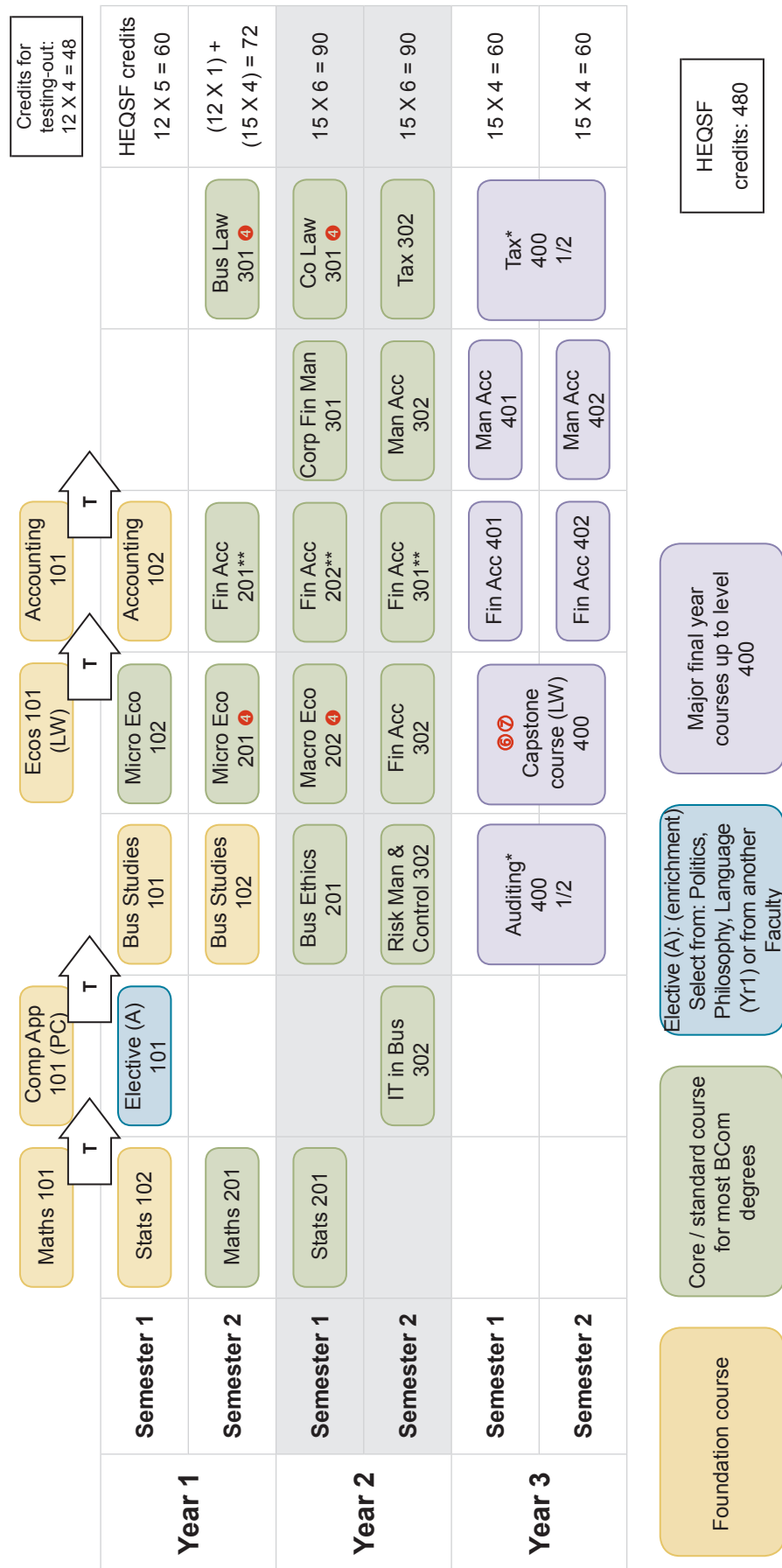
Year 1	Semester 1	Maths 101	Comp App 101 (C)	Bus Studies 101 (LW)	Ecos 101 (LW)	Accounting 101			HEQSF credits 12 X 5 = 60
	Semester 2	Stats 102	Elective (A) 102	Bus Studies 102 (LW)	Micro Eco 102	Accounting 102			12 X 5 = 60
Year 2	Semester 1	Maths 201		Bus Ethics 201 (LW)	Micro Eco 201	Fin Acc 201			15 X 4 = 60
	Semester 2	Stats 202		Bus Law 202	Micro Eco 202 (LW)	Fin Acc 202			15 X 4 = 60
Year 3	Semester 1		IT in Bus 302 (PC)	Co Law 301		Fin Acc 301 (PC)	Corp Fin Man 301		15 X 4 = 60
	Semester 2			Risk Man & Control 302		Fin Acc 302 (PC)	Man Acc 302	Tax 302	15 X 4 = 60
Year 4	Semester 1			Auditing* (LW) 400	Capstone course (LW) 400	Fin Acc 401	Man Acc 401 (PC)	Tax* 400	15 X 4 = 60
	Semester 2					Fin Acc 402	Man Acc 402		15 X 4 = 60
Foundation course							Major final year courses up to level 400		HEQSF credits: 480
Core / standard course for most BCom degrees							Elective (A): (enrichment) Select from: Politics, Philosophy, Language (Yr1) or from another Faculty		

* Two half-year courses, at final year level, to ensure same exit points

PC: Computer application

LW: Language and writing enriched

Figure 6: Curriculum exemplar for 3-year (accelerated) BCom programme (Accounting CA Option)



** Fin Acc (x2): accelerated option may result in combined course contents

* Two half-year courses, at final year level, to ensure same exit points

PC: Computer application

LW: Language and writing enriched

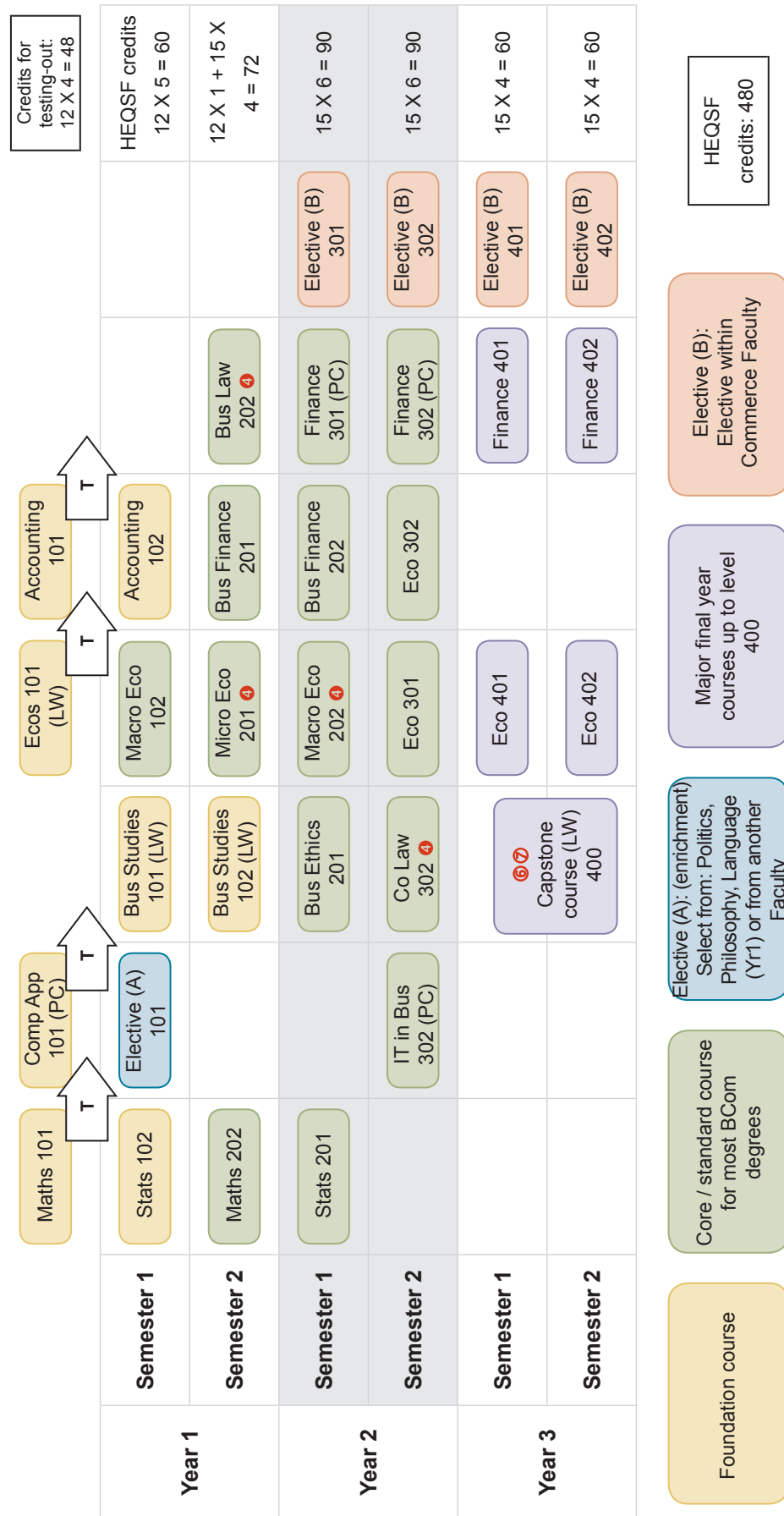
Figure 7: Curriculum exemplar for 4-year (mainstream) BCom programme (Finance and Economics)

Year 1	Semester 1	Maths 101	Comp App 101 (PC)	Bus Studies 101 (LW)	Ecos 101 (LW)	Accounting 101			HEQSF credits 12 X 5 = 60
	Semester 2	Stats 102	Elective (A) 102	Bus Studies 102 (LW)	Macro Eco 102	Accounting 102			12 X 5 = 60
Year 2	Semester 1	Maths 201		Bus Ethics 201 (LW)	Micro Eco 201	Bus Finance 201			15 X 4 = 60
	Semester 2	Stats 202		Bus Law 202	Macro Eco 202	Bus Finance 202			15 X 4 = 60
Year 3	Semester 1		IT in Bus 302 (PC)		Eco 301	Finance 301 (PC)	Elective (B) 301		15 X 4 = 60
	Semester 2			Co Law 302	Eco 302	Finance 302 (PC)	Elective (B) 302		15 X 4 = 60
Year 4	Semester 1			Capstone course (LW) 400	Eco 401	Fin Acc 401	Elective (B) 401		15 X 4 = 60
	Semester 2				Eco 402	Fin Acc 402	Elective (B) 402		15 X 4 = 60
<div>Foundation course</div>							<div>Major final year courses up to level 400</div>	<div>Elective (B): Elective within Commerce Faculty</div>	<div>HEQSF credits: 480</div>

PC: Computer application

LW: Language and writing enriched

Figure 8: Curriculum exemplar for 3-year (accelerated) BCom programme (Finance and Economics)



PC: Computer application

LW: Language and writing enriched

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2.4 Bachelor of Science – curriculum exemplars

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Introduction

As a point of departure for this report, it is acknowledged that research (Scott *et al.* 2007) has shown that the very large majority of South African students do not graduate with a BSc in the three-year minimum time and that a *flexible* framework based on a four-year Bachelor's curriculum as core, is both necessary and desirable.

The aim of this report was therefore to develop a series of exemplar four-year curricula for the BSc which would then be circulated across the sector for consideration, further debate and development. The exemplars are by no means intended to be the only possibilities although the central features of basic structure suggested here (see Section 1 below) have been identified as pivotal and as those which we believe, in combination, respond constructively to the complex challenges of student diversity and the differentiated educational opportunities which continue to impact on student success.

From the outset, it is crucially important to name the newly-structured curricula in such a way that they are positioned within the system as **the norm**, rather than as the “marked” version – as, for example, “extended” or “augmented”. In line with the briefing document, it is accepted that they are part of a collective attempt to establish a sensible starting point for the development of newly structured, four-year curricula and to normalise these within the higher education system. Given this, different routes (completing in three years, for example) through the undergraduate programmes would in future be considered the exception.

This report is divided into four sections. It begins with a brief overview of those aspects of the curriculum which have been identified as the key defining features of a reconceptualised four-year undergraduate structure. Then, on the basis of these, Section 2 outlines central underlying assumptions and areas of agreement which provide the conceptual framework within which the newly-structured curriculum can be understood (Section 3). This is followed in Section 4 by diagrammatic representations of a range of curricular structures, each of which retains the defining features of the basic curriculum identified in Section 1 while at the same time attempting to allow for alternative permutations and articulations between modules. These are directly linked to the nature and requirements of different knowledge domains and the extent to which they facilitate or constrain flexibility within the basic curriculum structure.

Section 1

Defining features of the four-year curriculum

While there is certainly the possibility of discipline-related variation within the basic structure, there are nevertheless several essential defining features of the four-year undergraduate science curriculum which are crucial for facilitating the successful assimilation of scientific concepts and for translating these into operational skills. In our view, it is necessary for the newly structured four-year curriculum to deal with the following issues.

- The new curriculum needs to recognise increasing student diversity as a central challenge and to reflect the importance of accommodating an increasingly diverse student population and, with that, different educational experiences and learning needs. This implies meeting all first-time entry students where they are and building on their knowledge and skills (see Section 2d and e).
- It needs to provide the large majority of students with **additional time and space within the formal curriculum** which will accommodate this diversity and allow for **a different distribution and pacing of material** across the four years. This will also result in greater depth and curriculum space for Academic Development and Enhancement (see Section 2a and Section 3).
- The curriculum must include (either through full integration into mainstream modules or via related “hybrid” courses) components of both academic development and enhancement. Although the boundaries between these often overlap, for the purposes of this report, academic development and enhancement are seen as separate enterprises. Academic development, which is a defining feature of the proposed new structure, includes, for example, modules which focus on the acquisition of the discursive practices, conventions and values within disciplines, additional tutorials within the curriculum, writing enriched modules, peer mentoring, problem-based learning, innovative student-centred pedagogy and field trips (see Section 2d and e). Precisely which of these components are selected and the way they are embedded into the curriculum will be dependent on both the disciplinary and the institutional contexts. Enhancement, which has been conceptualised here as offering additional contextual breadth and includes, for example, modules on the Nature and Philosophy of Science and/ or current global debates which may be considered essential in some curricula but not in others. In some highly structured curricula these modules may be seen as offering important but not essential value while in others, they may be viewed as playing a crucial role in developing the attributes desired in our students (see Sections 2a and f and Section 3).
- Academic development interventions should continue though into the second and third year of study as opposed to discontinuing them at the end of the first year as is currently often the case (See Section 2).
- Key points of transition should be identified in order to eliminate unrealistic demands and conceptual leaps (See Section 2b).
- The curriculum must cater for those students who demonstrate the ability to follow an accelerated route through the degree and to complete in a shorter time (see Section 3 below).

Section 2

Conceptual framework and underlying assumptions

This section explicates a set of assumptions which together provide the conceptual framework which informs the undergraduate science curriculum structure proposed here.

a. Curriculum structure

It is accepted that the Physical Sciences, where knowledge is strongly classified and largely vertically structured, require carefully paced and rigorously sequenced curricula (see Section 3), which are therefore likely to be less flexible than curricula in the Natural Sciences where questions of sequencing and pace, while important, are not quite as pivotal as they are in the Physical Sciences. In the Environmental and Biological Sciences, for example, it is possible to introduce more flexibility into the curriculum and this, in turn, has a direct bearing on the number and kind of electives or “enhancement” modules that can be included (See Section 2d). Despite disciplinary constraints, however, it is nevertheless important to construct curricula in all disciplines which enable us to think differently, for example, about conceptual progression, about how much content is included and also about how it is sequenced through the four-year period. It is crucial, however, that these questions, and their answers, are formulated within the context of particular knowledge domains. The notes accompanying the diagrams below go some way towards illustrating this process.

b. Identification of transitional points

It is extremely important to ensure that there is careful articulation between all years of study, but there are some points of transition that warrant special attention. The transition from school to university has long been recognised as a crucial one but in the science disciplines, and particularly in the Physical Sciences, the current transition point between first and second year has also proved to be exceptionally challenging for students. In many contexts, it functions almost as an additional selection procedure which has resulted in high attrition rates at the end of the first year. This, however, does not necessarily have to be the case. In the context of a new curriculum structure, it will be necessary to pay special attention to this particular transition point, and by distributing material in different ways over a longer period, to diminish large conceptual leaps and ensure a smoother transition between foundational material and increasingly complex concepts. A third transition point may exist between years 3 and 4, when the pedagogy features more project-based tasks where students need to take high levels of personal responsibility.

c. Entry and exit levels

While the entrance routes of students may be more flexible than in the past, every effort should be made to ensure the retention of exit-level standards. These will inevitably vary and will be institutionally determined (see Section 3 for further discussion).

d. Interventions and “enhancement” modules in the senior undergraduate years

One of the crucial differences between the large majority of current extended curricula, especially the “front-loaded” foundation-plus-three model, and the four-year structure proposed below, is that the academic development and/or enhancement activities are not withdrawn at the end of the first year but are extended into the senior years of the undergraduate degree until at least the end of the third year of study. This has an important bearing on the rest of the curriculum, in terms of the “curriculum load” and the disciplinary breadth/depth relationship. Three key principles come into play here; first, the academic development components should be accorded the same “standing” in the curriculum as the other modules, second, they should, at the very least, be closely linked to the mainstream modules (see 8.1 below) and third, they should be part of a reasonable curriculum load and never additional to it. This in turn has implications for the way in which other modules are structured.

e. The development of innovative pedagogy

There is some evidence to suggest that a structural change in itself, such as that proposed in this report, may result in improved undergraduate student performance and throughput rate. However, for the latter to increase significantly, it is also imperative that innovative pedagogies be developed in tandem with this structural change. In particular, if the time students spend in undergraduate programmes is to be lengthened, this requires curriculum space and innovations for deepening understanding, enhancing learning, and appropriate skill development. Underpinning this latter position is the belief that additional time without complementary pedagogical shifts, presents a real danger that the additional curriculum space will simply be viewed as an opportunity to take longer to do the same in the same way, which, in this perspective, is unlikely to achieve the desired increased throughput rates. In the context of this report, however, prolonged debate on whether or not the development of innovative pedagogies is absolutely essential to the success of the newly structured curriculum is unnecessary. There can be no question that a new structure is essential but we also know that, with or without the new structure, many current pedagogical practices in South Africa are in urgent need of transformation. There is no doubt that innovative pedagogy which makes appropriate use of new technologies will make a further positive contribution to the potential success of the four-year curriculum, both academically and in terms of developing the desired attributes in our students. The development of innovative pedagogies which cater for the growing student diversity will require both human and financial resources. Funding permitting, developmental programmes for academics could be put in place in anticipation of the implementation of the new curriculum structure. These programmes will need to identify and focus on crucial points of transition (see Section 2b) and will also need to include a more significant pedagogical shift from a focus on content to a new emphasis on process and problem-based learning, which includes the integration of emerging technologies (see Section d and e). This shift would acknowledge that it is not only what is taught that is central, but how it is taught that is of equal importance. A pre-condition for such programmes would be an in-depth knowledge of specific student profiles which will have some features in common nationally but will also be differentiated according to tertiary institutional type.

f. Student attributes

There has recently been an increased focus on the importance of the student attributes that tertiary institutions should develop in their students at undergraduate level. As the nature of these attributes is contested, they need to be identified and agreed upon, and then integrated into the curriculum. Currently, lists of highly desirable student attributes tend to be developed outside of the context of the curriculum which inevitably results in a disjuncture between what happens in the context of the curriculum and the development of such attributes (see Section 2d).

g. Developing multiple literacies

I. Language-related issues

In a context where an increasing number of undergraduate students speak English as a second or third additional language, the need to develop more appropriate academic literacy and other language-related interventions has become increasingly urgent. It is recognised that ideally, language-related material should be fully integrated into discipline-based modules but there is equally an acknowledgement that in many contexts, this is an unrealistic goal. At the very least, however, the starting point needs to be the recognition that the discourses, conventions and practices of disciplines differ, which implies that there is no place for generic language modules. The alternative is to develop hybrid modules which are additional to the discipline-based modules but which are developed in close collaboration with the disciplinary experts so that they focus on central skills and principles of the discipline as well as draw on material either directly from the course itself or on closely-related material. The key factor here is that the collaboration is on-going and regular and that the interventions are continually modified as student and disciplinary needs change (see Section 2d and e) and that the science genre is developed in undergraduate students.

II. Digital literacies

Increasingly, ICTs are being integrated into classrooms and students need to acquire a range of technologically-related literacies, ranging from the use of computers to the educational uses of social networking. While many students have high levels of literacy in these domains, there are still many who do not and provision should be made within the curriculum for those who need it. The newly-structured curricula will afford educators the opportunity to explore the possibilities of including ICTs in new and relevant ways.

Section 3

Practical considerations

1. Student selection

The large majority of students who meet the institutional admission requirements will be placed in the four-year undergraduate programme. However, some students may be selected through various mechanisms to accelerate through the curriculum by following a three-year programme.

2. Alternative progression routes

Although it is envisaged that the new 4-year BSc structure will be appropriate for most students, it is recognised that there are students who would be sufficiently prepared from school to complete the BSc in 3 years. The proportion of such students will vary from institution to institution, and hence the mechanisms to deal with these students may also vary. One of the important issues will be the process used to identify potential 3-year students and when the selection and placement will occur. This can be at the start of the first year with the consequence that the “usual” data (school results, NBT, etc.) will inform the process. Another approach would be to teach all students for a few weeks, and then use the results of first class tests as additional data to select students for the accelerated route. For the accelerated route to exist there would need to be in place a menu of courses in years 1 and 2 which allow flexibility of progress. An obvious way of doing this would be for the courses taught in the second half of year 1, and the first half of year 2, to be repeated in the alternative semesters. This flexible scheme will also allow students who fail such modules to catch up without too much delay. Another approach to dealing with an accelerated route would be to credit the student for all first-year courses and simply allow direct entry into year 2, without the need for extra course provision. The key to thinking about an accelerated route is that these students need to be accelerated without spending too much time on the initial stages of the 4-year curriculum, otherwise their chances of completing in three years will be compromised. Another issue to consider is that accelerated students are unlikely to benefit from the full suite of support and enrichment opportunities that a 4-year programme may offer.

3. Module credit point weighting

These and other technical matters are dealt with below in the diagrammatic representations of the various curricula.

4. Content of introductory first-level courses

The precise content of these courses, which run over a semester, which is the standard length of all modules, will be determined within the disciplinary context but will invariably contain foundational material which builds on school-leavers' levels of competency and which leads towards more complex concepts. There will be space in the curriculum (see the diagrams below) for additional modules, which will be determined according to student need but are likely to include language and technology-related modules, numeracy, writing and discussion of career choice etc. The inclusion of other additional enhancement courses (for example, interdisciplinary

modules developed around topical themes) will be dependent on the way in which the disciplinary knowledge is structured, which in turn will determine the amount of “curriculum space” available for such courses.

Section 4

Diagrammatic representations

1. A proposed structure for the 4-year BSc

A standard three-year BSc curriculum is represented below, where students nominally take 8 half courses, or equivalent, in year 1, then 6 half courses in year 2, and 4 half courses in year 3. Each year carries 120 HEQSF credits.

The course label A1a should be read, for example, as: A = Discipline A, 1 = 1st year level, a = first semester.

Table 1: A current standard structure for a 3-year BSc

Year	Semester	Courses				HEQSF credits	
1	1	A 1a	B 1a	C 1a	D 1a	15 x 4	60
	2	A 1b	B 1b	C 1b	D 1b	15 x 4	60
2	1	A 2a	B 2a	C 2a		20 x 3	60
	2	A 2b	B 2b	C 2b		20 x 3	60
3	1	A 3a		B 3a		30 x 2	60
	2	A 3b		B 3b		30 x 2	60

Historically, in some contexts, the three-year BSc was front-ended by a one-year “foundation” year, which typically did not carry any HEQSF credits. The BSc was still valued at $3 \times 120 = 360$ HEQSF credits, although students followed a structured 4-year programme.

One way of translating this structure from a foundation plus 3-year BSc programme into a 4-year BSc programme would be to keep the course structure and content the same, and simply assign HEQSF credit to the first year.

Table 2: A current 3-year BSc plus foundation year

Year	Semester	Courses				HEQSF credits	
1	1	A 0a	B 0a	C 0a	D 0a	15x 4	60
	2	A 0b	B 0b	C 0b	D 0b	15 x 4	60
2	1	A 1a	B 1a	C 1a	D 1a	15 x 4	60
	2	A 1b	B 1b	C 1b	D 1b	15 x 4	60
3	1	A 2a	B 2a	C 2a		20 x 3	60
	2	A 2b	B 2b	C 2b		20 x 3	60
4	1	A 3a		B 3a		30 x 2	60
	2	A 3b		B 3b		30 x 2	60

The main difficulty with this model is that it does not address issues around the distribution of load, particularly the step function between year 2 and year 3 in a 4-year BSc, which is the main stumbling block for a student's progression. Therefore we propose a redistribution of load (=topics) over the four years along these lines:

Table 3: A redistribution of load over four years

Year	Broad content
1	"Introductory material" and half of first-year material in old 3-year BSc
2	Second half of old first-year material plus roughly one quarter of old second-year material
3	Roughly three quarters of second-year material in old 3-year BSc
4	Roughly the same as third year material in old 3-year BSc, but with a modified didactic model

Here, "introductory material" refers to dealing with the foundational tools and skills appropriate for that discipline at a first-year level and beyond. The development of different "foundation" courses around the country has relevance here. This developmental provision at the start of the 4-year programme would include dealing with particular discipline-specific material, as well as developing tools for discourse within that discipline, computer skills, etc.

It may be desirable to offer a semester course "Introduction to the Sciences" which showcases the different disciplines in science. We envision that a number of departments could offer a two-week slot (the order of presentation may not matter, allowing a rotation system). The course would thus also provide space for students to make sense of their course and career choice, develop broader scientific literacy, and also be inspired by being introduced to hot topics in science, etc.

One of the first semester courses in Year 1 would need to be an introductory course in mathematics, which all students would take.

Table 4: A proposed model for first semester courses of Year 1:

"Introduction to the Sciences" [compulsory]
"Introductory mathematics" Mathematics 1a [compulsory]
Introductory courses in Physics, Chemistry, Earth and Life Sciences, Computer Science
Students choose the 2 most appropriate courses

Table 5: A proposed model for first semester courses of Year 1 without the "Introduction to the Sciences" course.

"Introductory mathematics" Mathematics 1a [compulsory]
Introductory courses in Physics, Chemistry, Earth and Life Sciences, Computer Science
Students choose the 3 most appropriate courses

In the second semester of the first year, all students continue with Mathematics 1b which will be likely to need two flavours: a terminating half course and a course which allows progression on to Mathematics 2a. An additional 3 half-courses would complete the course load in Year 1. These second semester courses of Year 1 in the 4-year BSc would reach a level similar to the first semester courses of the old 3-year BSc.

There may also be scope to introduce a course in "Scientific Methods" in Year 2 to deal with elements of statistics, experiment design and data analysis, and academic literacy and scientific reporting.

Table 6: The general framework for the 4-year (mainstream) BSc:⁶⁷

Year	Semester	Courses				HEQSF credits	
1	1	Intro: Sciences	Maths 1a	A 1a	B 1a	15 x 4	60
	2	C 1b	Maths 1b	A 1b	B 1b	15 x 4	60
2	1	C 2a	D 2a	A 2a	B 2a	15 x 4	60
	2	C 2b	D 2b	A 2b	B 2b	15 x 4	60
3	1	C 3a	A 3a	B 3a		20 x 3	60
	2	C 3b	A 3b	B 3b		20 x 3	60
4	1	A 4a		B 4a		30 x 2	60
	2	A 4b		B 4b		30 x 2	60

⁶⁷ The scheme does not depend on the existence of the "Introduction to the Sciences" course in Year 1, or the "Scientific Methods" course in Year 2.

Table 7: An alternative framework for a 4-year (mainstream) BSc where years 3 and 4 feature four modules in each semester.

Year	Semester	Courses				HEQSF credits	
1	1	Intro: Sciences	Maths 1a	A 1a	B 1a	15 x 4	60
	2	C 1b	Maths 1b	A 1b	B 1b	15 x 4	60
2	1	C 2a	D 2a	A 2a	B 2a	15 x 4	60
	2	C 2b	D 2b	A 2b	B 2b	15 x 4	60
3	1	A 3a	A 3c	B 3a	B 3c	15 x 4	60
	2	A 3b	A 3d	B 3b	B 3d	15 x 4	60
4	1	A 4a	A 4c	B 4a	B 4c	15 x 4	60
	2	A 4b	A 4d	B 4b	B 4d	15 x 4	60

2. A proposed structure for the accelerated route through the 4-year BSc⁶⁸

Table 8: An example of a 3-year (accelerated) route for the BSc.

Year	Semester	Courses					HEQSF credits	
1	1	Intro. to Sciences	A 1b	Maths 1b	C 1b	Elective 1b	15 x 5	75
	2	Elective 2a	A 2a	B 2a	C 2a	Elective 2b	15 x 5	75
2	1	B 2b	B 3a	A 3a	Elective 3a	20 x 3 15 x 1	75	
	2	A 2b	B 3b	A 3b	Elective 3b	20 x 3 15 x 1	75	
3	1	B 4a	A 4a	Elective 2a	30 x 2 15 x 1	75		
	2	B 4b	A 4b	Elective 2b	30 x 2 15 x 1	75		

68. 1. Students on 3-year route are granted exception from all the 1a suite of courses, except Intro. to the Sciences (if it exists), at a value of 30 credits. Each year of the three-year programme then carries 150 credits.
2. The 1b and 2a suite of courses would need to be taught in both semesters. This is usual practice where 3- and 4-year routes coexist at present. This also offers opportunities for catch-up to the 4-year students.
3. The order in which the 2b, 3a and 3b courses are taken would depend on the nature of the pre-requisites in place and is hence discipline specific. In the present three year BSc, the topics covered in second year are largely sequence-independent. Thus in the new 4-year BSc, the 2b, 3a and 3b courses would be sequence-independent for most disciplines.
4. The total number of credits allocated in this example is relatively high because of provision for electives in the interests of breadth. At some institutions, the kind of student taking the 3-year programme would be likely to be able to cope well with this workload. However, the credit load could be adjusted as far down as to 360 by omitting most of the electives.

Table 9: An example of a 3-year (accelerated) route through the BSc with majors in physics and mathematics

Year	Semester	Courses					HEQSF credits	
1	1	Intro. to Sciences	Physics 1b	Maths 1b	Applied Maths 1b	Elective 1b	15 x 5	75
	2	Elective 2a	Physics 2a	Maths 2a	Applied Maths 2a	Elective 2b	15 x 5	75
2	1	Maths 2b	Maths 3a	Physics 3a		Elective 3a	15 x 1 20 x 3	75
	2	Physics 2b	Maths 3b	Physics 3b		Elective 3b	15 x 1 20 x 3	75
3	1	Maths 4a	Physics 4a		Elective 2a		30 x 2 15 x 1	75
	2	Maths 4b	Physics 4b		Elective 2b		30 x 2 15 x 1	75

3. Selected examples of science majors

A few selected examples of a 4-year BSc are provided for a selection of double majors.⁶⁹

If both Maths 1b and Maths 2a (Physics 1b and Physics 2a, etc.) are taught in **both** semesters then this allows “catchnet” opportunities for students who fail. In this model, the entry point into a three-year “accelerated” route is at the start of Year 2.

⁶⁹ There is scope to explore the possibility of a double major incorporating a science discipline together with science education modules, leading to a suitable qualification for teaching mathematics or physical science at high school.

Table 10: 4-year BSc with majors in physics and mathematics

Year	Semester	Courses				HEQSF credits	
1	1	Intro. Sciences	Maths 1a	Physics 1a	Comp Sci 1a	15 x 4	60
	2	App Maths 1b	Maths 1b	Physics 1b	Comp Sci 1b	15 x 4	60
2	1	App Maths 2a	Maths 2a	Physics 2a	Comp Sci 2a	15 x 4	60
	2	App Maths 2b	Maths 2b	Physics 2b	Comp Sci 2b	15 x 4	60
3	1	App Maths 3a	Maths 3a	Physics 3a		20 x 3	60
	2	App Maths 3b	Maths 3b	Physics 3b		20 x 3	60
4	1	Maths 4a		Physics 4a		30 x 2	60
	2	Maths 4b		Physics 4b		30 x 2	60

Table 11: 4-year BSc with majors in chemistry and biochemistry

Year	Semester	Courses				HEQSF credits	
1	1	Intro. Sciences	Maths 1a	Physics 1a	Chemistry 1a	15 x 4	60
	2	Biology 1b	Maths 1b	Physics 1b	Chemistry 1b	15 x 4	60
2	1	Biology 2a	Maths 2a	Physics 2a	Chemistry 2a	15 x 4	60
	2	Microbiology 2a	Elective	Biochem 2a	Chemistry 2b	15 x 4	60
3	1	Microbiology 3a	Biochemistry 3a	Chemistry 3a		20 x 3	60
	2	Microbiology 3b	Biochemistry 3b	Chemistry 3b		20 x 3	60
4	1	Biochemistry 4a		Chemistry 4a		30 x 2	60
	2	Biochemistry 4b		Chemistry 4b		30 x 2	60

Table 12: 4-year BSc with majors in computer science and mathematics

Year	Semester	Courses				HEQSF credits	
1	1	Intro. Sciences	Maths 1a	Physics 1a	Comp Sci 1a	15 x 4	60
	2	Elective	Maths 1b	Physics 1b	Comp Sci 1b	15 x 4	60
2	1	Elective	Maths 2a	Physics 2a	Comp Sci 2a	15 x 4	60
	2	Elective	Maths 2b	Elective	Comp Sci 2b	15 x 4	60
3	1	Elective	Maths 3a	Comp Sci 3a		20 x 3	60
	2	Elective	Maths 3b	Comp Sci 3b		20 x 3	60
4	1	Mathematics 4a		Computer Science 4a		30 x 2	60
	2	Mathematics 4b		Computer Science 4b		30 x 2	60

Table 13: 4-year BSc with majors in ecology and applied biology

Year	Semester	Courses				HEQSF credits	
1	1	Intro. Sciences	Maths 1a	Biology 1a	Chemistry 1a	15 x 4	60
	2	Biology 1b	Maths 1b	Physics 1b	Chemistry 1b	15 x 4	60
2	1	Biology 2a	Maths 2a	Physics 2a	Chemistry 2a	15 x 4	60
	2	Biology 2b	Elective	Elective	Chemistry 2b	15 x 4	60
3	1	Biology 3a	Ecology 3a	Elective		20 x 3	60
	2	Biology 3b	Ecology 3b	Elective		20 x 3	60
4	1	Biology 4a		Ecology 4a		30 x 2	60
	2	Biology 4b		Ecology 4b		30 x 2	60

4. Selected examples of topics taught over the 4 years

Table 14a: Physics: An example of a present three-year curriculum

Physics 1a	Mechanics, Properties of Matter, Thermodynamics, Optics
Physics 1b	Electricity and Magnetism 1, Vibrations and Waves, Modern Physics
Physics 2a	Vibrations and Waves 2, Electricity and Magnetism 2
Physics 2b	Classical Mechanics, Quantum Mechanics
Physics 3a	Electricity and Magnetism 3, Statistical Physics
Physics 3b	Atomic Physics, Nuclear Physics, Solid State

Table 14b: Physics: A possible new four-year curriculum

Physics 1a	Foundational material (tools and skills for physics), Mechanics 1a
Physics 1b	Mechanics 1b, Properties of Matter, Thermodynamics
Physics 2a	Electricity and Magnetism 1, Optics
Physics 2b	Modern Physics, Vibrations and Waves
Physics 3a	Electricity and Magnetism 2
Physics 3b	Classical Mechanics, Quantum Mechanics
Physics 4a	Electricity and Magnetism 3, Statistical Physics
Physics 4b	Atomic Physics, Nuclear Physics, Solid State

Table 15a: Mathematics: An example of a present three-year curriculum

Maths 1a	Differential Calculus, Vector Geometry, Series
Maths 1b	Integral Calculus, Partial Derivatives, Matrix Algebra, Complex Numbers
Maths 2a	Advanced Calculus, Linear Algebra
Maths 2b	Real Analysis 1, Introductory Algebra
Maths 3a	Real Analysis 2, Advanced Algebra
Maths 3b	Complex Analysis, Real Analysis 3

Table 15b: Mathematics: A possible new four-year curriculum

Maths 1a	Pre-calculus and introduction to calculus
Maths 1b	Differential Calculus, Vector Geometry
Maths 2a	Series Integral Calculus, Matrix Algebra, Complex Numbers
Maths 2b	Partial Derivatives, Advanced Calculus
Maths 3a	Algebra 1
Maths 3b	Real Analysis 1
Maths 4a	Real Analysis 2, Algebra 2
Maths 4b	Complex Analysis, Real Analysis 3

Table 16a: Chemistry: An example of a present three-year curriculum

Chemistry 1a	Atomic Structure, Bonding, Inorganic Reactions, Acids and Bases
Chemistry 1b	Thermodynamics, Kinetics, Introductory Organic Chemistry
Chemistry 2a	Physical Chemistry, Spectroscopy, Thermodynamics 2, Solid State Chemistry
Chemistry 2b	Inorganic Chemistry, Reactions, Organic Chemistry
Chemistry 3a	Wave mechanics & spectroscopy, Catalysis, Inorganic Reaction Mechanisms
Chemistry 3b	Organic Structure and reactivity, Organic synthesis, Stereochemistry

Table 16b: Chemistry: A possible new four-year curriculum

Chemistry 1a	Foundational material, Microscopic and Macroscopic concepts, Atomic Structure
Chemistry 1b	Bonding, Inorganic Reactions, Acids and Bases
Chemistry 2a	Thermodynamics, Kinetics, Introductory Organic Chemistry
Chemistry 2b	Physical Chemistry and Spectroscopy
Chemistry 3a	Inorganic Chemistry
Chemistry 3b	Organic Chemistry
Chemistry 4a	Wave mechanics & spectroscopy, Catalysis, Inorganic Reaction Mechanisms
Chemistry 4b	Organic Structure and reactivity, Organic synthesis, Stereochemistry

Table 17a: Zoology: An example of a present three- year curriculum

Biology 1a	Intro. to Scientific Method, Evolution, Biomolecules, Cell Structure, and Genetics
Biology 1b	Introduction to Biodiversity and Conservation
Zoology 2a	Invertebrates- evolution, Ecology and Conservation, Ecophysiology
Zoology 2b	Vertebrates-evolution, Ecology and Conservation, Genetics
Zoology 3a	Ecology, Project, Evolutionary Physiology
Zoology 3b	Evolution, Behaviour

Table 17b: Zoology: A possible new four-year curriculum

Zoology 1a	Foundational Material, Introduction to Scientific Method, Evolution
Zoology 1b	Introduction to Biomolecules, Cell Structure and Genetics.
Zoology 2a	Introduction to Biodiversity and Conservation
Zoology 2b	Invertebrates- evolution, Ecology, Physiology and Conservation
Zoology 3a	Vertebrates-evolution, Ecology, Physiology and Conservation
Zoology 3b	Ecology, Project
Zoology 4a	Evolutionary Physiology
Zoology 4b	Evolution, Behaviour

2.5 Humanities and Social Sciences Bachelor's degree – curriculum exemplars

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1. Introduction

A number of assumptions underpin the exemplar of a BA/BSocSc curriculum that appears at the end of this document. The first is that the qualification will be registered at Level 7 of the Higher Education Qualifications Sub-Framework (HEQSF) with 480 credits and that these credits will be achieved by means of four years of study each consisting of 120 credits.

A second assumption is that the exit levels of the four-year curriculum are at the same level as those of the current three-year curriculum. This means that, after four years of study, a student should be able to display i) the same scope of disciplinary knowledge and complexity of understanding ii) at the same level as a student who completes a current three-year curriculum.

In addition, a student completing the degree over four years should have mastered the same levels of discipline-related practices as a student who completes a BA/BSocSci in the present system. The construct of 'discipline-related practices' is explained below.

Much has been made of the term 'academic literacy' in the literature on teaching and learning in higher education. Following the work of theorists such as Street (1984, 1993, 1995), literacy is understood to be a multiple phenomenon and to encompass not only a technical ability to encode and decode into and out of print but also a *socially constructed disposition* to read certain kinds of texts in certain kinds of ways; in other words, to become a certain kind of knower. An *academic* literacy therefore not only involves the ability to decode and encode print in sophisticated ways but also the willingness to engage with texts in ways sanctioned and legitimated by the disciplines. Reading and writing in the disciplines can therefore be understood as involving a set of sanctioned and legitimated *practices*.

There is evidence (see, for example, Lea and Street, 1998) that requirements regarding the way readers and writers engage with texts are specific to *individual* disciplines because of rules, conventions and practices related to knowledge-making within each discipline. At the root of academic reading and writing, therefore, are a set of discipline-based principles and values related to what counts as knowledge and how that knowledge can be known.

Gee (2007: 3) expands on what it means to be literate in order to encompass not only ways of reading and writing but also 'ways of behaving, interacting, valuing, thinking, believing, speaking, and often reading and writing, that are accepted as instantiations of particular identities (or "types of people") by specific groups'. From this perspective, an academic literacy encompasses an academic identity and goes beyond the ability to write and read certain kinds of texts in certain ways.

Following Gee (*ibid*), the assumption is that, at graduation, a student should have developed the ‘ways of behaving, interacting, valuing’ etc., and certainly the ways of reading and writing deemed to be appropriate by insiders to the discipline at Bachelor’s level. For the purposes of this document, these ‘ways’ are termed ‘discipline-related practices’. The assumption is then that, at the end of four years, a student would be able to demonstrate *at least* the same level of practice as those developed as a result of following current BA or BSocSci curricula. The phrase ‘at least’ is used here because the expectation would be that the additional year of tuition provided in a four-year curriculum could better allow the student to develop those practices than a three-year curriculum, provided teaching and learning activities were structured appropriately. It is at this point that curriculum design becomes an issue.

2. Curriculum design

2.1 Credits

In developing the curriculum, members of the working group have worked with the notion of ‘HEQSF credits’. Currently, Bachelor’s degrees are registered on the HEQSF with 360 credits. Given that the regulation minimum time for the completion of a Bachelor’s degree is three years, this means that each year of study should encompass approximately 120 credits. The provision of an additional year of study as the result of the introduction of a four-year curriculum would mean that an additional 120 credits are available.

Given that the exit point of a new four-year curriculum would encompass the same scope and complexity of understanding of disciplinary knowledge at the same level and also would expect demonstration of the same kinds and levels of discipline-related practices as the current three-year curriculum, this means that, effectively, an additional 120 credits are available to develop the same levels and amount of learning. The working group has found it useful to conceptualise these additional credits differently when developing the curriculum, as will become apparent later in this document.

2.2 Knowledge and practice

In South Africa, a great deal of interest is being directed at the work of British sociologist Basil Bernstein (1990, 2000, 2001) in order to understand curricula (see, for example, Luckett 2009, 2012; Shay 2011, 2012; Vorster 2011).

A key aspect of Bernstein’s work is his distinction between *vertical* and *horizontal* knowledge structures. In a vertical knowledge structure, typical of the natural sciences, knowledge is hierarchically organised in order to allow for ever more over-arching and abstract theories that can account for a greater range of empirical phenomena. Horizontal knowledge structures, typical of the Humanities and Social Sciences, on the other hand, ‘are not unitary but plural, consisting of a series of parallel incommensurable languages’ (Muller 2006: 12).

In a hierarchical knowledge structure, progress involves the development of new theories that subsume or can be integrated with the old. Knowledge building in a horizontal knowledge structure, on the other hand, involves the introduction of a new language constructing a ‘fresh perspective,

a new set of questions, a new set of connections, and an apparently new problematic and most importantly a new set of speakers' (Bernstein 2000: 162).

However, Bernstein's 'rough sketches' should not be taken to imply that there is no possibility of structuring a logic of progression in the Humanities and Social Sciences. Rather one needs to appreciate that this is more difficult and contested – with a wider range of possibilities – than may be the case in disciplines with a hierarchical knowledge structure. While the scope and range of possible content that could be covered in the Humanities and Social Sciences continues to grow exponentially – making the issue of selection problematic – key to developing a coherent four-year curriculum with a horizontal knowledge structure is to:

- limit content coverage (i.e. not to increase content coverage because of the provision of an additional year/120 credits of study),
- base the curriculum on a hierarchy of concepts, practices and dispositions to be acquired, and
- select appropriate content accordingly.

This would mean that a four-year curriculum would include the same 'amount' of content as a current three-year curriculum. The added year would allow for greater focus on a vertical 'spine' of concepts and practices running through the four years.

A 4-year major in **Historical Studies** could be based on the following 'vertical spine' of concepts and practices:

Year 1

- The ability to think historically and appreciate how the contemporary world is shaped by the past
- An understanding of chronology, evidence and causation as key organising concepts
- An understanding of what counts as evidence, including the distinction between primary and secondary sources
- An understanding of historical forces and how they operate and interact
- An understanding of causation in historical argument
- The ability to undertake a close reading of historical texts, locating texts in their historical contexts
- The compilation of glossaries of core concepts

Year 2

- An introduction to the key schools of historiography in South African history
- An understanding of the concept of historiography
- The ability to undertake a critical reading of historians' work
- An understanding of source criticism
- The ability to assess secondary texts
- The ability to assess historical controversies
- The ability to critique public history
- The ability to construct an evidence-based argument according to the conventions of the discipline

Year 3

- An understanding of the way in which the nature of history has changed over time
- The ability to identify and interpret a variety of primary and secondary materials
- The ability to undertake advanced source criticism on a wide range of sources e.g. historical newspapers, judicial records, film, interview transcripts, oral transcripts
- The ability to conduct on-line searches and to use database sources
- The ability to write a convincing argument on historiography

Year 4

- The ability to work as a novice historian
- The ability to assess the methods of historians from different schools by critically analysing historical evidence, historical writing and changing representations of the past in academic and public contexts
- The ability to examine historical debates by undertaking research according to current methodological conventions
- The ability to use primary sources based on archival research
- The ability to research and write a long essay or historical article.

Clearly work would be needed to explore the concepts and practices identified as core to a disciplinary area by experts.

2.3 An additional level of courses

Key to a four-year curriculum would be the introduction of a set of courses at a new Level 1 (of four Levels). The Working Group has conceptualised this new set of 'Level 1' courses at HEQSF level '5a' where the HEQSF level has been 'conceptually disaggregated' into two levels: 5a and 5b.

At most universities, the first year of the current three-year Bachelor's curriculum is conceptualised at Level 5 of the HEQSF. The theoretical split of this level into Levels 5a and 5b allows us to conceptualise a lower level of demand for students entering a curriculum spanning four, rather than three, years.

Level 2 of the four-year curriculum (i.e. the second year of study) is conceptualised at HEQSF Level '5b'. The remaining years of the curriculum sit at HEQSF Levels 6 and 7. The following table illustrates this schema:

Year of Study	Curriculum Level	HEQSF Level
1	1	5a
2	2	5b
3	3	6
4	4	7

The development of courses at the four levels of the four-year curriculum would then be dependent on the identification of a *vertical spine of concepts and practices* exemplified above in Section 2.2

of this document. While knowledge is critical to the curriculum, focus needs to be given to using content to develop the vertical spine of concepts and practices identified as central to disciplinary practice.

The Working Group is keen to emphasise the need to consider the amount of content covered in the curriculum carefully since an overload at the level of 'content' is likely to push underprepared students towards what are widely termed 'surface approaches' to learning (Entwistle and Ramsden 1983) focusing on rote learning and the memorisation of facts.

Given this concern, *at a conceptual level*, the Working Group has identified two different kinds of credits: 'knowledge' credits and 'practice' credits where the term 'practice' relates to the vertical spine of discipline-related concepts and practices. The Working Group believes it is useful to distinguish between credits in this way because the distinction i) encourages staff working with curricula to consider the vertical spine of concepts and practices students need to develop and ii) has the potential to place a limit on content. As the exemplar below shows, this spine can be made to run right up to Level 4 of the four-year curriculum.

It is important to note that the two kinds of credits identified by the Working Group are tools for curriculum design rather than a formal element of the system. There is no intention that the distinction should be used in anything other than at the curriculum design stage. For each course, it would be useful to distinguish between practice credits and knowledge credits to ensure that both aspects of learning are covered.

As the exemplar below illustrates, discipline-based courses in a four-year curriculum will appear at four levels. A discipline such as Sociology will therefore appear as Sociology 1, Sociology 2, Sociology 3 and Sociology 4.

An alternative to discipline-based courses could be included at the Level 1. Such courses could focus on the development of quantitative or computer literacy or on other elements of academic study. For example, one variant could be courses which focus on the close analysis of texts. Such courses could provide a generic platform for students to acquire the skills entailed in a close reading of texts that are seldom taught a school level, but required in all Humanities disciplines (including Law). Key concepts and skills to be acquired in such a course might include:

- An understanding of the different functions of texts: texts as expression, representation and persuasion
- The ability to use the basic elements of textual analysis: content (connotation, imagery, metaphor, circumstance, nominalisation), context (register, genre, discourse, intertextuality), mode (cohesion and coherence)
- The ability to undertake active reading: locating and critiquing authorial voice and positioning of the reader (voice, mood, modality)
- The ability to summarise and synthesise different sources
- The ability to write an academic essay, taking a position, developing an authorial identity in writing
- The ability to construct an argument: understand and identify premises, warrants, conclusions and fallacies.

Pedagogy

In developing a new four-year curriculum, it is necessary to consider pedagogy as well as structure. Given academic cultures and the likelihood that very few established academics might be willing to devote the sort of attention to developmental pedagogy as would be desirable, it would be possible to conceptualise the 'knowledge' credits of the new curriculum as 'delivered' by discipline based academics in traditional teaching formats such as lectures and, higher up the curriculum, seminars.

The new 'practice' credits could then be facilitated by a new breed of academic teacher or teaching assistant – preferably postgraduate students who were planning an academic career and who had had some sort of introduction to teaching and learning provided by professionals in this area. The 'practice' credits would be 'delivered' via more informal teaching methods such as workshops and tutorials. Postgraduate students would then draw on their experience of teaching 'practice' credits in their discipline as they pursued academic careers of their own. In this way, they could eventually have the potential to have an impact on teaching approaches across departments as they rose through the academic hierarchy. Clearly, high levels of interaction between both kinds of academic teacher would be necessary.

Alternatively, the academic development professionals, who are already employed in many universities, could be drawn upon to teach these developmental credits, provided they had some grounding in the discipline and hence credibility with the academics in the department concerned.

2.4 Fast-tracking progression

It is necessary to allow for some students to progress through the new curriculum at a faster pace in order to complete the BA/BSocSci degree in three, rather than four, years.

This fast-tracking could be allowed by recognising their readiness to learn at tertiary level as a form of prior learning. This prior learning would be conceptualised at the theoretical HEQSF Level 5a. If this prior learning were recognised on the basis of performance in the National Senior Certificate (NSC) or some other form of test such as the National Benchmark Test (NBT), qualifying students could move straight on to Level 2 of the new four-year curriculum.

The table below shows both three-year and four-year routes through a four-year curriculum. In this model, 4-year track students would have to take 24 courses while 3-year track students would take only 16 courses (i.e. they would be exempt from the 8 courses in Year 1 of the 4-year curriculum). The degree itself would be awarded on the basis of an individual having credit for all 24 courses, even though some of this credit had been awarded on the basis of prior learning.

Students granted exemption from courses at Level 5a on the basis of their prior learning could be allowed to register for one or two additional courses per year at the discretion of the Faculty. These additional credits would provide credits *supernumerary* to those required for the degree. This is an important point, as the courses for which exemption has been granted must be seen as integral to the 480 credits required for the degree.⁷⁰

⁷⁰ HEQSF Level 5a is intended as a conceptual tool only. Up to 30 credits at level 5a could be dedicated to specialised courses including, for example, courses on computer literacy, textual analysis or numeracy. The 30 credits allowed for these courses could be split into smaller units.

FOUR-YEAR DEGREE 8+6+6+4=24 courses (480 credits)				THREE-YEAR TRACK 6+6+4=16 courses + exemption from 8 courses on the basis of prior learning (480 credits)		
HEQSF Levels + Credits	1 st Semester	2 nd Semester		1 st Semester	2 nd Semester	HEQSF Levels + Credits
5a 8 x 15 = 120	Sociology 1	Sociology 1				Credit and exemption for up to 120 credits for prior learning deemed equivalent to the Level 5a provision required for the degree.
	History 1	History 1				
	Anthropology 1	Anthropology 1				
	Politics 1	Politics 1				
5b 6 x 20 = 120	Sociology 2	Sociology 2		Sociology 2	Sociology 2	5b 6 x 20 = 120
	History 2	History 2		History 2	History 2	
	Politics 2	Politics 2		Politics 2	Politics 2	
6 6 x 20 = 120	Sociology 3	Sociology 3		Sociology 3	Sociology 3	6 6 x 20 = 120
	History 3	History 3		History 3	History 3	
	Politics 3	Politics 3		Politics 3	Politics 3	
7 4 x 30 = 120	Sociology 4	Sociology 4		Sociology 4	Sociology 4	7 4 x 30 = 120
	History 4	History 4		History 4	History 4	

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