A FRAMEWORK FOR THE APPROPRIATE PLACEMENT OF FIRST YEAR STUDENTS IN SCIENCE, ENGINEERING AND TECHNOLOGY PROGRAMMES AT A SA UNIVERSITY

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1. Context

This paper focuses on the placement of the first-year students entering Science, Engineering and Health Science programmes. The rapid decline in the throughput of students in disciplines such as Mathematics, Physics and Chemistry at first year level at the University of Johannesburg (UJ), informs the investigation. The graduation rate of Science students is alarmingly low, where only 18% of students complete their three year studies in the minimum three years. Approximately 38% complete four-year professional degrees in precisely four years. Furthermore, the participation of Black students in Science, Engineering and Technology (SET) programmes (at 12%) slightly increased over the past few years, but still only one out of every three Black students graduate in five years (Scott 2007). Table 1 demonstrates that at the UJ the throughput rate for Chemistry, Physics and Mathematics at the first year level is unsatisfactory across four cohorts spanning 2006 to 2009. In particular, Table 1 also highlights a dramatic deterioration in the throughput rate in 2009.

Table 1 ***First-year throughput*** (Adapted from UJ report 2009)

Module	**2006 (Total enrolment)**	**2007 (Total enrolment)**	**2008 (Total enrolment)**	**2009 (Total enrolment)**
Chemistry 1	**54% (844)**	**66% (517)**	**68% (304)**	**46% (461)**
Physics 1	**49% (603)**	**43% (435)**	**47% (332)**	**34% (468)**
Mathematics 1	**58% (876)**	**61% (456)**	**65% (404)**	**43% (990)**

Chemistry, Physics and Mathematics modules are generic to SET and Health Science programmes and form the core of the first-year curriculum in these programmes. Large numbers of first-year students have been dropping out in higher education for many years (Bunting 2004 & Scott 2009b:21), particularly in the three modules listed in Table 1 (UJ 2009; Engelbrecht, Harding and Phiri 2009:289 and Potgieter 2009). Lecturers have long complained about the quality of students and have put the blame on schools, university administrators and the quality of students (Scott 2009b:25 and Biggs & Tang 2007:17-19). However, the sharp increase in student enrolment witnessed in the last few years, impacts negatively on throughput and therefore has funding implications. More students and less success is forcing Natural Science, Engineering and Health Science faculties to rethink their processes and practices with respect to the selection and retention of students.

This research reflects on the influence of the curriculum and teaching and learning strategies followed in first-year Fundamental Science modules. The dependency on contents and skills developed at school in specifically Science modules is emphasised. The assessment of students entering programmes offered in a comprehensive university is investigated, and strategies needed by the institution, the individual student and each specific programme to deliver graduates are suggested. The empirical deductions are based on the data collected on the performance of first-year students at school and university, using proficiency testing and personality assessment (Strydom 1997:54 and Scott 2009b:25).

It is against this background that this paper reports on the development of a framework for the placement of students in SET programmes at a comprehensive university in SA. The deductions from a comprehensive review of policies and relevant research, followed by an empirical investigation into factors that influence student performance, form the foundational principles for the development of the framework.

2. Conceptual framework

The framework is based on foundational principles at three levels of engagement namely: SA Higher Education (HE) in general, Fundamental Science disciplines and ultimately the performance of first-year students in SET.

The review of relevant HE policies post 1996 highlights directives such as the widening of access to university education (NCHE report 1996) and the improvement of student throughput rates (RSA: The White Paper 3 on HE Transformation 1997a). The enhancement of quality of teaching and learning strategies were emphasised with the promulgation of the HE Act and the National Plan (RSA: The HE Act 1997b; RSA: The National Plan on HE 2001). Changes to government funding criteria (RSA: Student Enrolment Planning in Public Higher Education 2004) has prompted Science programmes to change their current teaching and instruction paradigms. Proficiency in Science is recognised as a scarce skill, which necessitates the development of innovative student enrolment and retention strategies.

Previously the teaching of Fundamental Science modules was seen as a continuation, broadening and deepening of the content and skills acquired at school level (Engelbrecht *et al.* 2009:293 & Floyd, Evans and McGrew 2003:155). However, contemporary school leavers appear to be poorly skilled and underprepared for the challenges of university education in Science and Mathematics (Jansen 2007:91, Maree, Aldous, Hattingh, Swanepoel and Van der Linde 2009:229, and Engelbrecht *et al.* 2009:293). These problems can be attributed to changes in the school curriculum and other systemic problems in the school system, but Gardner (2003:12), Foxcroft and Stumpf (2005:12) and Maree, *et al*. (2006:229) indicate that first-year students fail and drop out all over the world.

Tinto (1993:45 and 1999:5-9) reminds university educators that there are factors above and beyond the mastery of subject specific content at school that influences performance at university. The following factors contribute to student throughput according to Tinto (1993:45):

- Appropriate curriculum design
- Increased classroom interactions
- Accommodating diversity
- Financial support
- Helping students to develop a sense of belonging
- Appropriate placement of students to match course content to their abilities
- Developing student preparedness.

The SA government has indicated the urgency of students completing their studies as stipulated in the WPHE (1997a:53). Dedicated additional earmarked funding is provided as incentive to encourage improved completion of studies by students. Several key performance indicators of student success emerged in international higher education during the 90s, of which student persistence (which also serves as an indicator of student satisfaction) and retention are the most prominent (Levitz, Noel & Richter 1999:31). In the USA, Australia, Canada and UK retention management has developed in a well-researched and scientific area of specialisation, with the credo: "(T)he success of an institution and the success of its students are inseparable" (Levitz *et al*. 1999:40).

Higher education in SA has to consider the management of retention as suggested by Levitz *et al*. (1999: 41). A longer term strategy develops a campus culture with the following characteristics:

- The institution creates a student success structure.
- Intensive contact with 'at-risk' students.
- Academic advisors that understand the needs and motivational levels of students.
- Lecturers that are actively engaged with the students and take initiative for the relationship.
- Attention being paid to the adaptation and individual needs of the students.
- Celebration and recognition of successes by members of staff who are actively dedicated in their quest to motivate students to move to the next level.

A tailor-made application of the abovementioned characteristics by SA universities (each according to its own institutional culture) would change higher education radically. The current perceived culture (and expectation) is still that a student is relatively well-prepared (based on school grades and experience) and mature when arriving on campus. Another perception still held by many lecturers is that those students who fail their university studies should not have been admitted in any case, so called academic 'Darwinism'. It is only over the past two to five years that SA universities have become aware of needs for intervention and have actively explored First Year Experience (FYE) and academic orientation. Student enrolment management and retention-enhancing initiatives are well-known concepts in many foreign institutions, but have yet to be formalised in SA higher education. It is during the scientific planning and structuring of programmes that most of the necessary relationships between the student and the institution are established – relationships that could mean the difference between eventual higher education study success and student experiences of failure.

3. Links to international best practice

This investigation compares trends in international admission practices with those employed locally. The investigation also compares international teaching and learning strategies in Science programmes with strategies employed at South African universities. The unique multicultural, multilingual and socio-economic context of higher education in South Africa dictates that the influence of culture, language and diversity on performance at university level must be examined (Maree 2009:263, Engelbrecht *et al.* 2009:294). Research on selection and admission testing in South Africa focused primarily on predictors of academic success (Huysamen & Raubenheimer 1999, Maree 2003 & Schepers 1992). Astin (2005), Tinto (1997) and Pascarella and Terenzini (2005) identified additional indicators of academic success. This research reflects on the influence of the curriculum and teaching and learning strategies followed in first-year Fundamental Science modules. The dependency on contents and skills developed at school in specifically Science modules is emphasised. The assessment of students entering programmes offered in a comprehensive university is investigated, and strategies needed by the institution, the individual student and each specific programme to deliver graduates are suggested.

4. **Analysis**

The development of the framework proceeded on the basis of two types of analysis. Firstly, a review of the relevant research based literature and governmental policies were performed with the aim of identifying the guidelines in the context of higher education. Secondly, an empirical investigation into factors that influence student success, retention, and throughput was conducted across four cohorts of first year students, spanning the years 2006 to 2009. Data were collected from students in SET degree programmes (BIng, BSc and BOptom) at the University of Johannesburg.

The data consist of school results and biographical and personality profiles as well as academic proficiency measured by the Stellenbosch University Access Test (Du Plessis and Menkveld 2009). Degree and diploma programmes as well as programmes in Engineering, Health Sciences, Natural Sciences, Agricultural Sciences and related programmes all have generic Sciences as part of first year curriculum and outcomes of this study would be applicable and could be contextualised to similar programmes.

4.1 The main findings based on the **literature-review** highlight the following aspects.

- Universities are implementing **context-specific strategies** to fulfil national policy expectations (Yeld 2009 & Scott 2009a).
- The **National Curriculum Statement** resulted in a change of focus towards the delivery of competent citizens, but also exposed less qualified teachers and a perceived inflation of Grade 12 school results (Nel and Kistner 2009:958, Sproule 2009, Rademeyer 2009:398 and Maree 2009:261-264).
- The **teaching approach and curriculum at university level** will have to change because the school system is unlikely to change soon (Jansen 2007:91, Scott 2009a). Students need more support and it is increasingly expected that lecturers provide first-year students with more than content knowledge.

4.2 The main findings based on the **empirical investigation** indicate the following:

- The **performance of students in first year at university level** shows a remarkable decline in 2009 in comparison to 2008 and 2007 (see Table 1 above).
- The **relations between biographical variables and first-year performance in Science modules**.
  - o Students selected on a competitive basis perform better and are more likely to succeed than students who only had to meet minimum entrance requirements.
  - o No relation between gender and academic performance was observed. This contrasts with the commonly held view that men perform better in SET related programmes.
  - o More mature students perform better than their younger counterparts.
  - o Home language is significantly related to academic performance. Proportionally, more students with Indigenous African home language were placed in the 'high risk' category than students with English, Afrikaans or even 'other' languages as home languages. Foxcroft and Stumpf (2005:7) researched academic performance and second language and identified reasoning as a fundamental problem. Floyd *et al.* (2003:155) found that language processing was important for the maintenance of mathematic skills. Van der

Walt (2009:379) recognised the fact that only when students felt confident and proficient in the language would they be able to fully comprehend the mathematical structure. The 'word problem' in Mathematics also found application in Physics and Chemistry which created problems in all three disciplines. Also note that the home language concept remains confounded with group differences in socio-economic status and access to quality education, such that students with an Indigenous African home language might be expected to have had less access to quality educational resources.

- Finally, ethnicity had a significant relation with university performance. A relatively high proportion of Black students were placed in the '*high risk*' category (31%) in comparison with White (17%), Coloured (23%) and Indian (20%) students. Ethnicity is also confounded with home language and therefore with socio-economic status and access to quality education. It appears safe to assume that most of the Black students would also be from a home where the first language would be Indigenous African and this would imply that many of above reasons could be applicable based on ethnic classification.

- The **predictive value of overall school performance with regard to success in first-year Science modules**.

Traditionally, students were admitted to study in SET programmes on the basis of their high school achievement as reflected in the so-called **M-score** [2006 to 2008] and the **APS** [2009]. In this study the M-score could be used to predict overall university performance reasonably well in the first semester. The APS demonstrated weaker predictive power than the M-score. The application of the global Grade 12 score as an instrument together with other variables had been suggested by Foxcroft and Stumpf (2005:7-10) and Foxcroft (2009). However, the total Grade 12 score is important to provide a more nuanced instrument to have student proficiency measured.

- The correlation of **school performance in individual subjects** with **first-year performance in Science modules**.

  - **Grade 12 English** results of students showed a significant relationship with university performance such that students with better Grade 12 English marks performed better in Science modules.

  - **Grade 12 Mathematics** results of students reveal a statistical significant relationship with university performance. Mathematics had been identified as a 'rite of passage' and it is reported (by Brombacher 2004:1 and Volmink 2009) that more learners (an increase of 10%) had passed Mathematics in Grade 12 in 2008 and 2009, than passed Higher Grade up till 2007. Nevertheless, the Grade 12 Mathematics results for 2006 to 2009 cohorts showed statistical significance and would still be one of the predicators of university performance.

  - **Grade 12 Physical Science** results predicted academic performance at university level (in 2006 to 2008). Nel and Kistner (2009: 968) indicated that Grade 12 Physical Science results were inflated but more so for the lower performance candidates.

- An examination of the **predictive value of an independent scholastic proficiency test** (SU Access Test) with regard to **success in first-year Science modules**.

  - The SU **Mathematics Access Test** predicted overall university performance as also found by Nel and Kistner (2009:953-973).

- Similarly, the SU **Physical Science Access Test** predicted overall university performance. The Physical Science Access Test provided useful information to indicate overall university performance. Nel and Kistner (2009:953-973) explained the use of these results as a yardstick for benchmarking.

In the analysis of the academic performance in university modules with regard to overall Grade 12 results (M-score/APS) and the two SU tests, in the disciplines (Mathematics, Chemistry and Physics), a hierarchical multiple regression revealed the following:
The SU Access tests explain a significant amount of variance in academic performance in the first year, after the predictive value of high school performance had been taken into account. Hence, the SU Access tests appear to add significantly to the prediction of first year success. Tables 2, 3 and 4 summarises the relative contributions of SU Access tests, after controlling for high school performance.

- For the **Mathematics** at first year level the M-score in 2008 explained 12.4% of the variance in the Mathematics module. The predictive contribution of the two SU Access Tests revealed better predictability in 2009. The SU Access Test added significant contribution towards the predictability of performance in Mathematics in first year in 2009 (at around 17%).

Table 2 ***Proportion of Variance in First Year Mathematics modules explained by Mathematics and Physical Science Access Tests and M-score / APS***

Module	Cohort	n	Variance explained by the M-score/APS %	Additional variance explained by the Access Tests %	Total variance explained %
MAT 1A	2008	131	12.4	6.5	18.9
	2009	42	5.9	17.2	23.1

- For the **Chemistry** at first year level the M-score in 2008 explained 28.4% of the variance in the respective module. The predictive contribution of the two SU Access Tests revealed better predictability in 2009. The SU Access Test added significant contribution towards the predictability of performance in Chemistry in first year in 2009 (at around 24%).

Table 3 ***Proportion of Variance in First Year Chemistry modules explained by Mathematics and Physical Science Access Tests and M-score / APS***

Module	Cohort	n	Variance explained by the M-score/APS %	Additional variance explained by the Access Tests %	Total variance explained %
CEM1A	2008	99	28.4	3.1	31.5
	2009	46	1.7	23.9	25.6

- In the **Physics** modules there was no predictive contribution of the M-score toward the performance in Physics in first year in 2008 and a very small contribution from the two SU Access Tests. The predictive contribution of the APS was very small in 2009 but the results of the two SU Access Tests revealed better predictability to predict almost 36% of the performance in Physics in first year.

Table 4 ***Proportion of Variance in First Year Physics modules explained by Mathematics and Physical Science Access Tests and M-score / APS***

Module	**Cohort**	**n**	**Variance explained by the M-score/APS %**	**Additional variance explained by the Access Tests %**	**Total variance explained %**
PHY1A	2008	130	0	4.7	4.7
	2009	42	3.1	32.6	35.7

5. Discussion

Deductions from literature and empirical analysis indicate the **foundational principles of the framework** for placement. The most important of these principles are:

- The **SA school system** is unlikely to change in the near future**.**
- Universities are **assessing the strengths and weaknesses of every individual student** to ensure that quality learning can take place.
- Universities are providing a planned and structured '**First-year Experience**' programme (including orientation, curricular, co-curricular, support and transition components) over the first year of study.
- Universities are concerned and allow for a **generic phase,** where students can settle down before being placed into specialised Science programmes.
- First-year Science lecturers are knowledgeable specialists and should be adopting the **appropriate methodology** to implement at first-year level of the fundamental curriculum.
- The first-year Science curriculum at universities provides for inclusion of **English language proficiency, computer literacy, academic literacy and career counselling**.
- Science faculties at universities are involved in and acknowledge the role that **Science teachers** play in the cultivating and recruitment of potential Science students.

The suggested framework is grounded on the above foundational principles derived from the research. Furthermore the principles will be arranged into guidelines (or pre-conditions) that will direct the actions to establish the framework for placement. The identification of guidelines play an undeniable role in the development of the framework, as the feasibility of the guidelines will determine if the framework is at all practically executable. Four guidelines are suggested below.

5.1 **The Establishment of a First Year Enrolment Centre**

In most of the SA universities certain core functions are centralised and others are decentralised. Every institution manages functions such as student admission, recruitment, marketing, finances, administration and human resources as either centralised or/and decentralised, depending on unique structures within the university. This investigation proposes that Enrolment Management of first-year students resides within a centralised institutional Enrolment Centre. This centre should collate the core processes such as recruitment, applications, admissions and registrations, in collaboration with faculties, support divisions, finances and other stakeholders. Furthermore, this centre should coordinate the tracking of students, research on trends and throughput as well as enrolment and the capping of numbers.

The management of enrolment is very important to every university and should be regarded as such. Gardner (2003:4) expresses concerns that students perform well at school with little effort and have the same expectation for university. Another function of such a centre could possibly be to coordinate and manage the academic orientation of new first-year students – the First-Year Experience. Academic orientation firstly be compulsory and credit-bearing if we want it to succeed. Lecturing staff should be involved in this process and get acquainted with students as soon as possible.

The First-Year Enrolment Centre is to be an academic centre where the first-year students, the first-year lecturers and support staff collaborate and feel safe. It is not an administrative 'post-office' handling applications and executing the policies constituted elsewhere. This centre should be informing the rest of the university on the latest trends, perform research and be the niche where interdisciplinary activities and decisions are generated to ensure that successful first-year students continue to become successful post-graduate students.

5.2 Design of a four year (BSc) and five year (BIng) degree or diploma

To realise the full potential of placement, there is a need for more time to be engaged with the first-year student. The student, as well as the institution, needs more time to adapt to each other. In the light of literature on drop-out most of the students in Science programmes take longer than the prescribed three years to graduate. Similarly, very few students graduate in Engineering after four years. It is, however, very important that the current offering (three year BSc and four year BIng), remains as the path of acceleration for the already 'ready' and self-directed student.

This research proposes that the BSc becomes a four-year degree option. This four year option furthermore should be the default with most students being placed in this extended stream, without the stigma and labels that accompany the existing extended programmes. Furthermore, the four-year BIng degree should be extended to a formal five-year degree also as the default option. The condition for the BSc (IV-option) and BIng (V-option) is that it consists of a well planned and structured curriculum. Purely extending and adding foundational provision will not ensure success of students: the institution must also change the curriculum and delivery of the curriculum.

Students and lecturers experience the 'gap' between school and university and this additional year can be perceived as the 'gap-year' – not taking a 'gap' but bridging the 'gap'. The structure of the four/five year option will provide time for the student to adapt in a safe and nurturing environment and also give the institution time to analyse and profile the student to provide assistance and support where needed. The suggested structure can also be adapted to make provision for students in the National Diploma and could fully realise if student have the opportunity to articulate between the degree and diploma options.

The student in Science, Health Science and Engineering will apply to the university with an indication of a programme and by adhering to admission requirements the student will be admitted to the Science programmes. These could be managed as a 'Science college' where all the students will follow the same curriculum. Due to deficits in the school Mathematics and Physical Science preparation for higher education all students will be registered a generic first semester. This generic first semester provides fundamental support and foundational provision and students will then enter two semesters to complete the current first semester content. After these three semesters the students should be equipped and ready to slot into the mainstream delivering students after three semesters to complete the second semester of the current first year. All students enter the first semester and during this time students get acquainted with the higher education culture and work ethics, in other words ‘bridging the gap’. Unsuccessful students may be placed in other fields or programmes (from degree to diploma) with less problems than currently the case. After completion of these three semesters the successful student progress to the last semester of the first year curriculum and they should then be able to cope with the level and tempo required to enter the second year. The students identified for the acceleration programme articulate after the first quarter and complete the first year (carefully planning the next eight months with less holiday time).

5.3 **Assessment of first-year students**

To realise the full potential of every student the institution needs to assess every incoming student. During the generic first semester, the institution will be able to measure the potential as well as cognitive and non-cognitive abilities of every first-year student. Early diagnosis of any deficits would implicate ‘in-time’ support and knowledgeable counselling will enable students will be able to make informed decisions on career paths ahead. Placement will manifest in ‘fitting’ of students in programmes where they would be more successful. Choices in majors, distinction between degree and diploma and articulation possibilities will all be available based on the profile of the student.

In practice very few potential students have access to career counselling. Strangely, those exceptional students who have gone for evaluation often do not trust the advice from counsellors. The experience of the researcher is that students make choices and adhere to their choices until academic problems start. How would a school prepare a learner on the differences between Mining Engineering, Extraction Metallurgy and Metallurgical Engineering? The assessment of students will also prove to them (and maybe parents) over a time-span what is best and which choices to make based on information collected.

5.4 **First-year teaching and learning strategy**

The emphasis on the adjustment and challenges that first-year students face, mostly precipitate during the formal lecture. Gardner (2003: 14) explains the dynamics of the lecture where the actual contact of student and institution (personified by the lecturer) takes place. It is here where new students are confronted with content of new disciplines and where familiar content may become a nightmare. The suggestion is that institutions carefully design a ‘First-year teaching strategy’. This strategy should provide guidelines, steer teaching and support for lecturers and provide a forum where first-year lecturers can share best practices. Furthermore, such a strategy should include coordinated provisional support provided to first-year students. The appointment of additional and suitably qualified staff (specialised for teaching first-years), budgeting for the additional services into smaller class groups are some of the important issues that should be encapsulated in such a strategy. The successful placement will attempt to place the student in the most suitable programme and therefore the most suitable lecturers should be appointed to teach and inspire students

Lecturers appointed to teach first-year curriculum would be cultivating the post-graduate class of the future. Careful selection of these staff would include staff with confidence and teaching with passion. Staff with education qualifications and influence would compliment the specialised methodology to commence with the fundamental Science concept and delivering students at a higher level. The strategy should provide opportunity for the alignment of curriculum content (e.g. when will Physics require which topics in Mathematics). The strategy could possibly also propose a coordinated assessment system for first-years within a programme.

The framework for bridging the gap is presented in Figure 1.

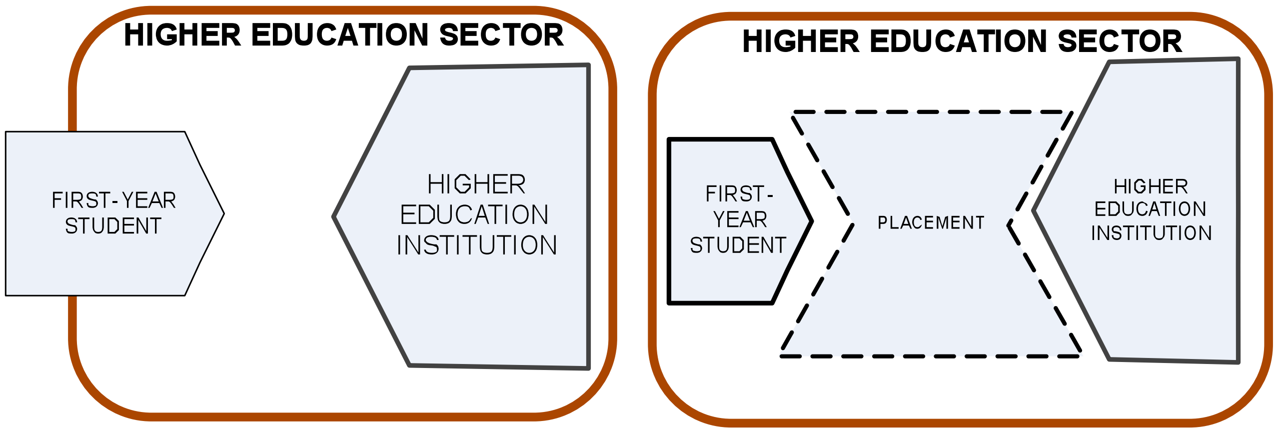

Figure 1 **The placement framework bridging the gap between the first-year student and institution**

In Figure 1 the 'gap' between the first-year student and the institution is filled with the 'placement' hexagon transforming the two shapes (representing the first year student and the institution) to 'fit' into each other. The illustration in Figure 2 indicates the findings filtered into three categories namely, higher education, and Science at university and first-year Science students. The funnel then leads to the 'Placement Framework' fitting into the 'gap' between the first-year student and the university. The continuous research refines the context and role of all the role-players and builds the model to grow and develop.

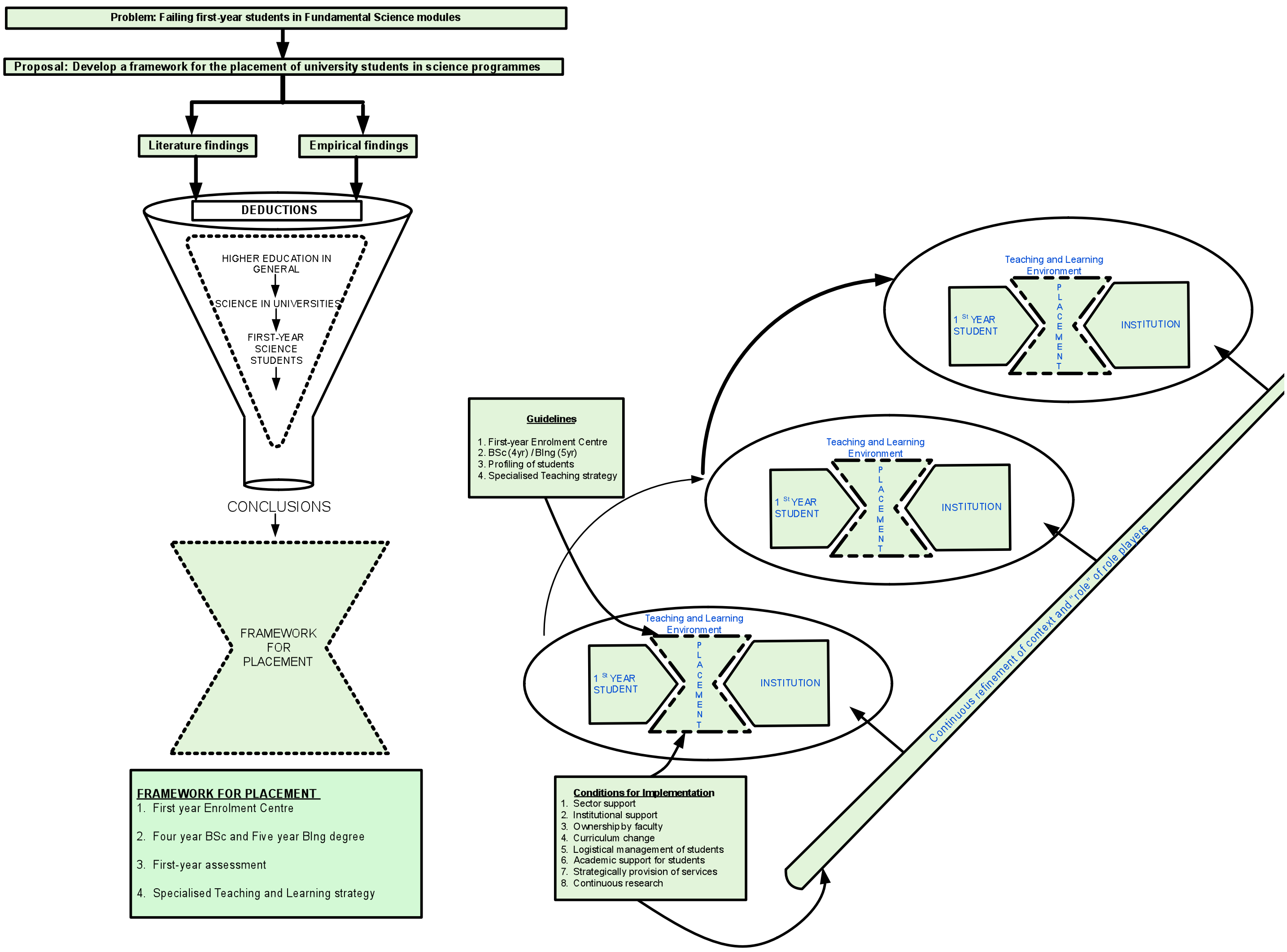

Figure 2 **Framework for placement of students in Science programmes**

5.5 Conditions for the implementation of the Framework for placement

Based on the literature survey and findings of this study some pre-conditions have been identified that have to be satisfied for the framework to be successfully implemented. The proposed framework could realise if the following enabling conditions are met:

- Sector support, which means that the higher education Science fraternity embraces the proposed four-year BSc or Diploma option (or the five-year option for Engineering). Furthermore, the Department of Higher Education and Training has to support the extended degree or diploma options with legislation and support the establishment of enrolment centres with funding in order to provide the institutions with capacity to populate these. The funding of students should improve as this proposed structure strives to enhance throughput and retention of students in the system.
- Institutional support, which means that institutional management, provides resources and status. Lecturers teaching and involved in this "First Year Experience" programme will have to be carefully selected and trained

to perform these sophisticated lecturing duties which should not be regarded as remedial work. The constructive alignment of the processes, policies, programmes, places and people to the special curriculum.

- Faculty members must accept the merits of the framework.
- Changes to the academic curriculum that will make provision for compulsory class attendance and smaller class groups for lecturing. Integration of study skills into discipline curriculum as well as English language enhancement. Specialised curriculum designers are working with content specialists.
- Sufficient logistical support to manage the needs of students and staff.
- Academic support of students by an intense involvement with first-year students in smaller groups by lecturing staff, mentors (senior students) and support from diverse divisions within the institution. The counselling of students every week in mentor sessions should cover extensive life orientation and include self-management and development of a personal roadmap for every student.
- Strategic provision of services and support, which means to provide profiling, assessment and counselling of first-year students from pre-admission to placement. This requires psychometrists, educational and career psychologists. The strategic placement of students matching to the programme profile requires decisions to be made by panels of experts, guided by the proposed first-year teaching and learning strategy.
- Continuous research into the strengths and weaknesses of the framework.

6. Conclusion

The study intended to develop a framework for placement of first-year Science students and has provided foundational principles that can be applied to other fields of study as well as other institutions. The framework has not been tested in practice but certain aspects have been applied with success. The study performed an overarching investigation across disciplinary boundaries and provided insights related to Fundamental Science e.g. Mathematics, Physics and Chemistry that brought comparisons and differences unique to these fields, to the surface.

Placement should be regarded as a constructive and meaningful response to the School-University gap in SET programmes and will change the 'face' of the institution. Institutions have to move closer to the entering student and facilitate the transformation of the first-year student by filling the 'gap' with structured, planned care and academic support for the first-year Science student.

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