

# The throughput of Mining Engineering Students in the University of Johannesburg (2009 to 2013 Cohorts)

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## Abstract

The analysis of throughput rates involves the calculation of how many students in a given cohort completed their degrees and graduated within the stipulated time, how many dropped out, and how many took longer than the stipulated time to graduate. In the University of Johannesburg throughput is calculated as the number of students who graduated in a given cohort over the number of students enrolled. It is disheartening to realise that some students end up out of university for a number of reasons and this contributes to the throughput rate calculation. Scott et al. (2007) suggests that a lack of academic 'preparedness', in terms of both social class and the high school curriculum is one of the reasons why students fail to or take longer to master degree requirements. While the study done in 2010 by the Council on Higher Education, Higher Education Monitor on access, retention and throughput, reports amongst others that lecturers' pedagogical resources and the institutional environment are factors that contribute to students' success or failure in a university. Some students have financial pressures that oblige them to work while they study or take breaks between years to earn, which delays their progress in the university. According to skillsportal South Africa there has been misalignments between institutions teaching style and students' learning styles which is believed to have a direct impact on throughput rates. This paper reports on the throughput rate of Mining Engineering students in the University of Johannesburg with a particular focus on the 2009 to 2013 cohorts. The paper delves into the causes of some students in Mining Engineering National Diploma failing to complete their diploma requirements. The paper should inform students, their families, academics, higher education institutions as well as the government as the main funder of higher education.

## 1. INTRODUCTION

The study done by the Human Science Research Council lead by Letseka (2007) on student drop-out rates revealed that students' socio economic status plays a significant role in the students' ability to persevere in their studies. The study revealed that 70% of the students who dropped out were from families with a low socio-economic status. For example, the parents or guardians of students from low socio-economic status earn between R400 –R1600 per month. The students would have to take up part-time or piece jobs to compensate for their low economic status, and that time affects their study period and hence they dropout. The demographics in the study revealed that Blacks/African students comprised the largest proportion of the low socio-economic status, followed by coloureds and Indians. This indicates that students entering higher education institutions come from positions of extreme inequality especially when considering financial resources.

Scott et al. (2007) argues that a lack of 'preparedness' from the high school curriculum is one of the reasons why students fail to master their degree requirements or drop out. Other studies have shown that students' success or failure depends on numerous factors such as students' readiness, lecturers' pedagogical resources, socioeconomic factors and the institutional environment. While other factors such as the misalignment between the Higher Education teaching style and students learning styles has been classified as one of the key factor resulting in students failing to master their degrees/diplomas at the minimum required time. In high school the teacher gives information to learners from that one prescribed text book, whereas in tertiary institutions students are expected to go beyond what the lecturer offers in class and obtain information and research themselves. No lecturer follows the students around to check whether they have done the work they were supposed to do, everything is entirely up to the student.

### 1.1 Student profile

A considerable change has been observed in the past two decades in student enrolment, there has been an increase in the number of Black/African students that enroll in universities. The study done by the Council on Higher Education (CHE), Higher Education Monitor (2010) reports that the proportion of black students rose by 40% in 1999, 61% in 2004 and 72% of the total student body in 2005. The influx of students was also observed in the year 2009 shortly after the introduction of the National Senior Certificate (NSC) in the year 2008.

### 1.2 Throughput

South Africa has been reported to have one of the lowest graduation rates approximately 15% (Mafenya, 2014). The South African government has voiced its concerns regarding graduation rates, it has been reported saying that it's costing the national government a huge deal in terms of resources due to poor academic performance. The government is of a belief that funds given to the universities are wasted on admitting students who will never graduate, and hence always threaten to reduce funding because the funds offered did not yield the desired outcome. Simkins et al. (2007) points out

that South Africa spends proportionately on education than other developing countries, however performs the worst when it comes to Mathematics and Science. This suggests that there is a poor use of resources resulting in an inefficient education system. In the year 2001 the Department of Education (DoE) reported that dropout rates cost the country R 1.3 billion a year. Throughput is important in higher education institutions because it informs the funding framework of the graduation rates which assists the government in allocating funds for different institutions; by looking at the graduates produced per year (Letseka, 2007). According to the Department of Education (2009), the overall throughput rate in Engineering averaged around 60% between 1996 and 2005, however this number is seen to decrease over the years.

Throughput refers to how much data enters and goes through something in a given amount of time and it is used to measure the performance (dictionary). In 2011 the Engineering Council of South Africa (ECSA) conducted a study on throughput in a few South African universities and they admitted that throughput is a challenge in the country. Graduation rates, dropout rates and retention are good indicators of throughput in a given cohort and are used in this study to show throughput rates for Mining Engineering National Diploma. Graduation rates are calculated by dividing the total number of qualifications awarded at an institution by the total number of students enrolled. There is only so much information that can be inferred from the graduation rate, as it does not clearly indicate the time lag from enrolment to graduation and the different durations of qualifications. According to Daniel et al. (2006) a dropout is an individual who does not complete a learning programme or who takes a path that does not lead him or her to graduate successfully with the associated qualification.

The Higher Education Monitor (HEM) conducted studies at three of South African Universities, the University of Pretoria (UP), University of Witwatersrand (Wits) and University of Western Cape (UWC). At the University of Pretoria, the dropout rate (retention) is monitored precisely; a study of the year 1996, 1997, and 2000, to 2005 three year programmes was conducted. A significant increase in the dropout rates increased in these cohorts. The study revealed that, 6.8% students enrolled in the year 2000 had left by the end of the year. In UP the study also revealed that less than 40% of the students complete their degrees within the minimum required time.

At Wits, the Working Group on Retention and throughput, conducted a study for the year 1992 to 1998 cohorts. The study revealed that less than 50% of the students graduate in the minimum time required. Most students get excluded due to financial and academic reasons. The study also made considerations of race and it shows that white students perform academically better than their black counterparts. The females are also reported to perform better than the male students (HEM, 2010). Wits obtained comments from its faculties on the reasons why some students drop out, get excluded and take long to master their degrees. The reasons varied from different faculties from poorer schooling, heavy workloads, financial problems and poor curriculum counselling.

At UWC a more qualitative approach was conducted in carrying out these studies. UWC monitored the year 2000 to 2005 cohorts, and the year 2001 to 2004, a significant increase in students dropping out was observed and the reasons for such included amongst others the quality of intake, economic, social and academic factors. In the year 2006 about 1 439 students were academically excluded (HEM, 2010). It was also found that few students complete their studies in the minimum period of three or four years and many students require more than that.

## **2. STUDY OBJECTIVES**

The main aim of this paper is to inform and raise awareness about the throughput rate of students in the Mining Engineering Department in the University of Johannesburg (UJ). This study should inform Higher Education institutions, Department of Higher Education and families of students about the factors that contribute to student success and failure while pursuing their diplomas. The paper considers the time it takes for students to graduate, and those students that leave without completing their studies (drop outs). This paper should challenge the current status in this particular diploma so that improvements are seen, changes implemented in the new BEngTech programme to commence in the year 2017 and students can have the best undergraduate education experience. The focus of the analysis and recommendations will be on the support mechanisms and systemic changes that may be required, to better enable and support talented but academically under-prepared and disadvantaged students to succeed in mainstream engineering programmes.

## **3. METHODS**

The research methods used in this study included both quantitative and qualitative techniques. Both these techniques were used for their robust ability to provide clarity when analysing data. To achieve the objectives set by this study, cohorts from 2009-2013 of first time entrant students were considered. This means that the study does not make considerations of students who were retained from the 2008 cohort. The data was obtained from HEDA, Higher Education Management Information System (HEMIS) reports and the Director of Data Governance Ms. Annamarie Meyer in the University of Johannesburg assisted in the understanding and making sense of the data. To obtain a robust qualitative analysis the following were undertaken:

1. Structured Interviews were conducted with the Head of Department of Mining Engineering in UJ and the senior academic staff of this department.
2. Interviews were conducted with the Head of Department of Metallurgy in UJ.
3. Interviews were conducted with students (First years) who have peers that have dropped out, to investigate the factors that might have made those students fail to complete their diploma. First year students were interviewed because high dropout rates are generally observed in the first year of study.

- Interviews were conducted with students to investigate why some take longer to master their diplomas (why they fail to finish in the minimum required time).

The researcher asked for permission from lecturers to interview students as a group in class and also outside class as individuals. The interviews were voluntary, the names of students were not known to the researcher.

#### 4. STUDY AREA

The area of focus for this study is the University of Johannesburg's Mining Engineering Department. This department was chosen for several reasons such as the easy access of data to be analysed also because a study like this has never been conducted for this department before. The Mining Engineering Department at UJ was established in 1925 from the Witwatersrand Technical Institute and that was later called Witwatersrand Technikon (Lurie, 2000). This department is situated very close to the Johannesburg City center in Doornfontein Campus. It has produced a number of graduates, who are mostly reported to be directly involved with production and are mine managers in the companies where they are employed.

#### 5. DISCUSSION

##### 5.1 Student profile of Mining Engineering students

Table 1.1 shows the demographics of Mining Engineering students for the past five years. It can be seen that though there is still a high number of males than females, there is a significant increase in the number of females that enroll for the diploma. The student ages range from 19- 45 years with the highest percentage of students that enroll being around 19-25.

Table 1.1: Student Profile for Mining Engineering Diploma

| Year | Females | Males |
|------|---------|-------|
| 2009 | 19      | 73    |
| 2010 | 26      | 52    |
| 2011 | 30      | 79    |
| 2012 | 40      | 85    |
| 2013 | 14      | 72    |

##### 5.2 Mining Engineering National Diploma Entry requirements and Curriculum

The National Diploma is a three year 360 credit qualification. The minimum entry qualification for the Mining Engineering National Diploma is a Matric Senior Certificate with a Diploma endorsement. The Diploma requires the learner to have done Mathematics and Physical Science as well as English with an overall APS of 25 points. The Technical College route of N3 equivalence is also accepted, also

applicants who have industry experience with some courses from UNISA are accepted in the qualification. Table 1.2 shows the courses done in the Mining Engineering Diploma from first year (S1 and S2) up to third year (S4 and S5). It can be observed from Table 1.2 that mathematics and science form part of the first year courses, thus students with strong mathematical and scientific background are required hence the entry requirements. The second year P1 and P2 is the year of practicals where students go and work in mining companies and they sometimes obtain their rock breakers' certificate at this stage. The third year is when they do specialised mining engineering courses such as ventilation and rock engineering just to mention a few (Department of mining engineering and survey, 2016).

Table 1.2: Mining Engineering National Diploma Curriculum

| Course/Module identification                   |                                  | Course/Module identification                   |                             |
|--|----------------------------------|--|-----------------------------|
| Code   | Name                             | Code   | Name                        |
| <b>Semester S1: Compulsory Courses/Modules</b> |                                  | <b>Semester S4: Compulsory Courses/Modules</b> |                             |
| CSA121   | Communication Skills 1           | MEG3211  | Mine Engineering 3          |
| BQT1112  | Quantitative Techniques 1        | MGN32-1  | Engineering Management 3    |
| EIRM111  | Computer skills 1                | MIN32-1  | Mining 3                    |
| MOT111   | Mineral Exploitation 1           | MSV3211  | Mine Survey and Valuation 3 |
| MWT111   | Science: Mining 1                | MTL3211  | Mining Technical Services 3 |
| MAT1AW1  | Engineering Mathematics 1        | MWG3211  | Geology: Mining 3           |
| <b>Semester S2: Compulsory Courses/Modules</b> |                                  | <b>Semester P1: Compulsory Courses/Modules</b> |                             |
| EDM111   | Mechanical Engineering Drawing 1 | EL33911  | Experiential Learning 1     |
| CAD111   | Computer Aided Draughting 1      | <b>Semester P2: Compulsory Courses/Modules</b> |                             |
| MAT2AW2  | Engineering Mathematics 2        | EL33912  | Experiential Learning 2     |
| MAS11-1  | Accounting Skills 1              |  |                             |
| MWS111   | Engineering Work Study 1         |  |                             |
| ENM31-1  | Environmental Management 3       |  |                             |
| <b>Semester S3: Compulsory Courses/Modules</b> |                                  |  |                             |
| GLG3AMM  | Mining Geology 2                 |  |                             |
| MBF21-1  | Mineral Beneficiation 2          |  |                             |
| MEG2111  | Mine Engineering 2               |  |                             |
| MGN21-1  | Engineering Management 2         |  |                             |
| MIN21-1  | Mining 2                         |  |                             |
| MSV2111  | Mine Survey and Valuation        |  |                             |

### 5.3 Staff profile of Mining Engineering Department

The Mining Engineering National Diploma is mainly a vocational programme, therefore the staff members are expected to be both academically and practically knowledgeable. Most of the staff members are very well experienced in the mining industry, however still lack the post graduate qualifications. Table 1.3 shows the Mining Engineering National Diploma staff profile. From the table it can be seen that there are more male lecturers than female lecturers and the predominant age group is above 35. The Mining Qualifications Authority (MQA) supports five lecturers in the department as part of the HDSA capacity building programme (Department of mining engineering and survey, 2016).

Table 1.3 Mining Engineering National Diploma lecturers profile

| Title | Position     | F/P/S | Speciality                       | Departmental affiliation | Qualifications |              | Experience in years |            |
|-------|--------------|-------|----------------------------------|--------------------------|----------------|--------------|---------------------|------------|
|       |              |       |                                  |                          | Academic       | Professional | Academic            | Industrial |
| Mr.   | Lecturer     | F     | Eng. Management                  | Home                     | MSc            | Applied      | 3                   | 23         |
| Mr.   | Lecturer     | F     | Mining                           | Home                     | BSc Eng        | Applied      | 10                  | 11         |
| Mr.   | Lecturer     | F     | Mining                           | Home                     | BSc Eng        | Candidate    | 2                   | 6          |
| Dr.   | Snr Lecturer | F     | Mine Engineering                 | Home                     | PhD            | Candidate    | 8                   | 3          |
| Mr.   | Lecturer     | F     | Beneficiation                    | Home                     | B Tech         | Candidate    | 2                   | 5          |
| Mr.   | Lab Tech     | F     | Laboratory                       | Home                     | B Tech         | Candidate    | 5                   | 5          |
| Mr.   | Lecturer     | F     | Mining                           | Home                     | BSc Eng        | Applied      | 9                   | 14         |
| Mr.   | Lecturer     | P     | WIL                              | Home                     | ND             | Nil          | 10                  | 34         |
| Mr.   | Lecturer     | P     | Mining Science & TS              | Home                     | ACSM           | Pr Cert Eng  | 30                  | 14         |
| Mr.   | Lecturer     | F     | Surveying                        | Home                     | M Tech         | -            | 8                   | 20         |
| Ms.   | Lecturer     | F     | Surveying                        | Home                     | B Tech         | -            | 3                   | 1          |
| Mr.   | Lecturer     | F     | Quantitate techniques            | Home                     | MSc            | -            | 10                  | 7          |
| Ms.   | Lecturer     | F     | End gap – developmental position | Home                     | B Tech         | Candidate    | 0.5                 | 7          |

#### 5.4 Throughput indicators

This study uses data of students who enrolled for the first time in a given cohort from 2009 to 2013. First time enrolment means that the person is effectively registered in the collection period for an undergraduate or pre-diplomate course and in the past has not been effectively registered in any higher education course at the institution or any other higher education institution (HEDA, 2016). The data of students who were already on the system but still in first year in 2009 to 2013 is ignored. The following variables are used for data analysis:

1. Retained students these are students who remain in a particular year of study and do not proceed to the next level for one reason or the other.
2. Drop out students is the number of students from the cohort who did not return in the consecutive year/years after the cohort year to continue their studies. These are students who have failed to complete their National Diploma in Mining Engineering in this paper.
3. Graduates are students who have successfully completed their national Diploma in Mining Engineering. These are students who fulfilled the requirements of the qualification in a reporting/academic year and this is irrespective of the ceremony awarded year.
4. African refers to black South Africans
5. International refers to all non-South African citizens.
6. Minimum required time refers to the period of three years that it should take for students to complete their diploma programme in Mining Engineering.

There is unfortunately no data recorded for students that have moved to other faculties, students that failed to complete the mining engineering diploma are all classified as having dropped out.

### 5.1.1 First Time Enrolments for all Mining Engineering students National Diploma

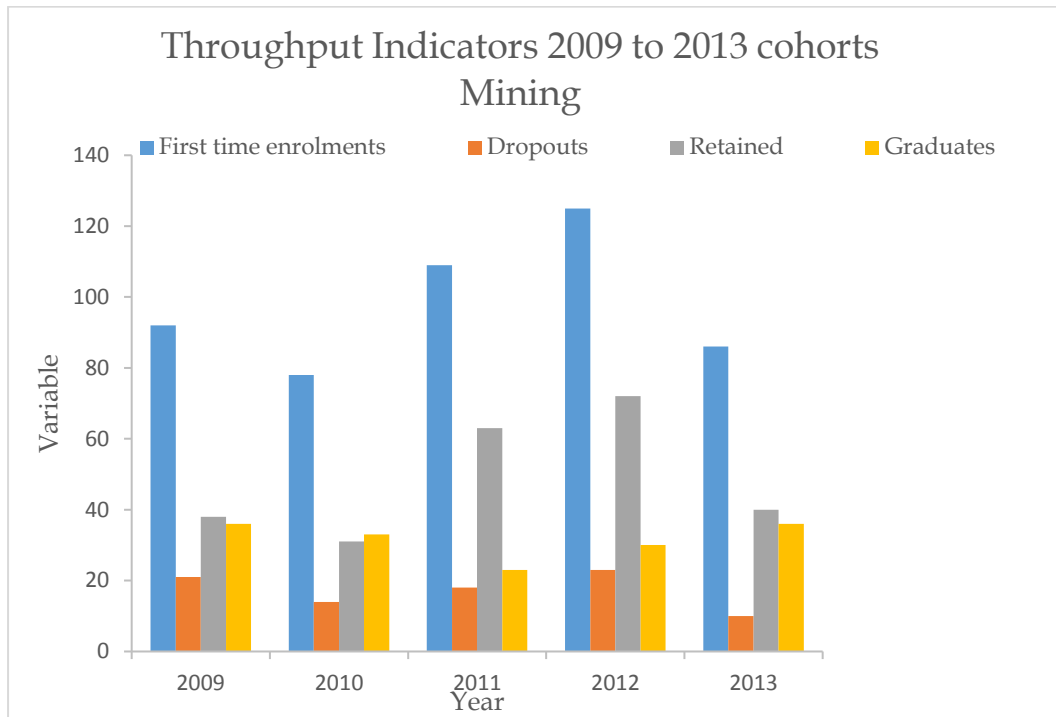


Figure 1.1 Throughput Indicators 2009 to 2013 cohorts Mining Engineering National Diploma

As previously defined, first time enrolment means that the person is effectively registered in the collection period for an undergraduate or pre-diplomate course and in the past has not been effectively registered in any higher education course at the institution or any other higher education institution (HEDA, 2016). A similar trend is observed for the student enrolments and students retained (see Figure 1.1). There has been a fluctuation of student enrolment numbers over this five year period (2009-2013) and similarly the retained students. The highest number of students enrolled is seen in 2012 and the highest number of dropouts is also seen on this particular year. The senior academic staff in mining engineering explained that there could be a positive correlation between increased enrolments and dropouts. This is still to be investigated further.



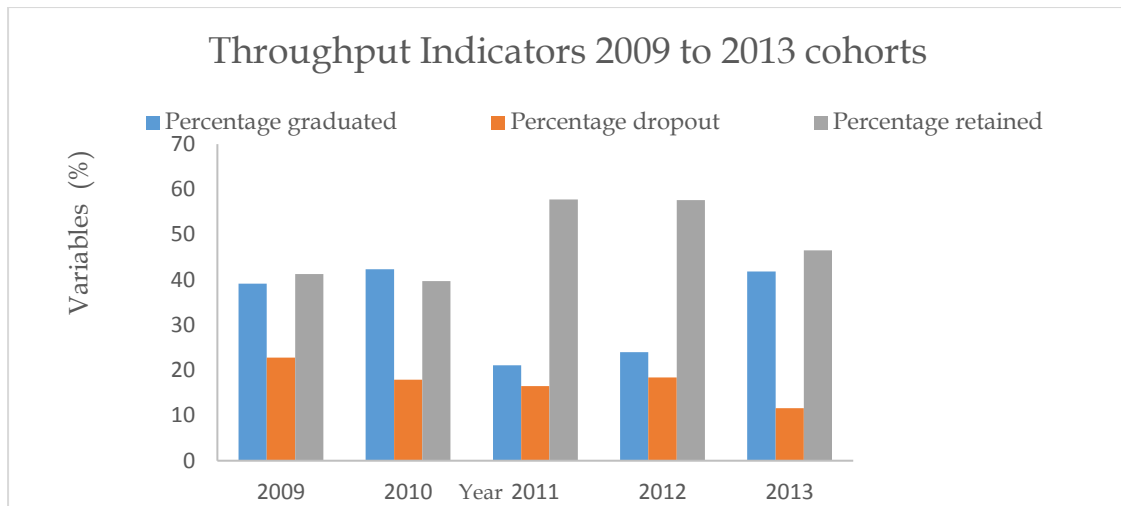


Figure 1.2 Percentage of throughput Indicators 2009 to 2013 cohorts Mining Engineering National Diploma

It can be seen in Figure 1.2 that on average less than 40% of students complete their Mining Engineering Diploma at the minimum required time of three years. This graph also shows that on average the percentage students retained in a cohort is above 50%. This suggests that more students are kept in the system and do not complete their diploma in the minimum required time. Figure 1.2 also illustrates that approximately 20% of students drop out of the Mining Engineering Diploma in the first two years of study. The senior academics in the mining engineering department were interviewed and asked to comment about these trends and several reasons were given by them. For students that dropout, the senior academics mentioned that students fail to adapt, adjust and cope with their first year university experience. They also mentioned that the lack of preparedness of students that come in especially in mathematics causes failure and thus students drop out. Figure 1.3 shows the overall performance of first year Mining Engineering students in their various modules. Mathematics does seem to be the module in which students perform the least. It has the lowest percentage of students passing, while it shows that Mathematics has the highest number of students registered. The academics attributed the poor performance in mathematics to the National Senior Certificate (NSC) allowing a 30% pass mark of any three subjects as well as a 40% pass mark, already this poses a problem for students because the university pass mark is 50% for all modules.

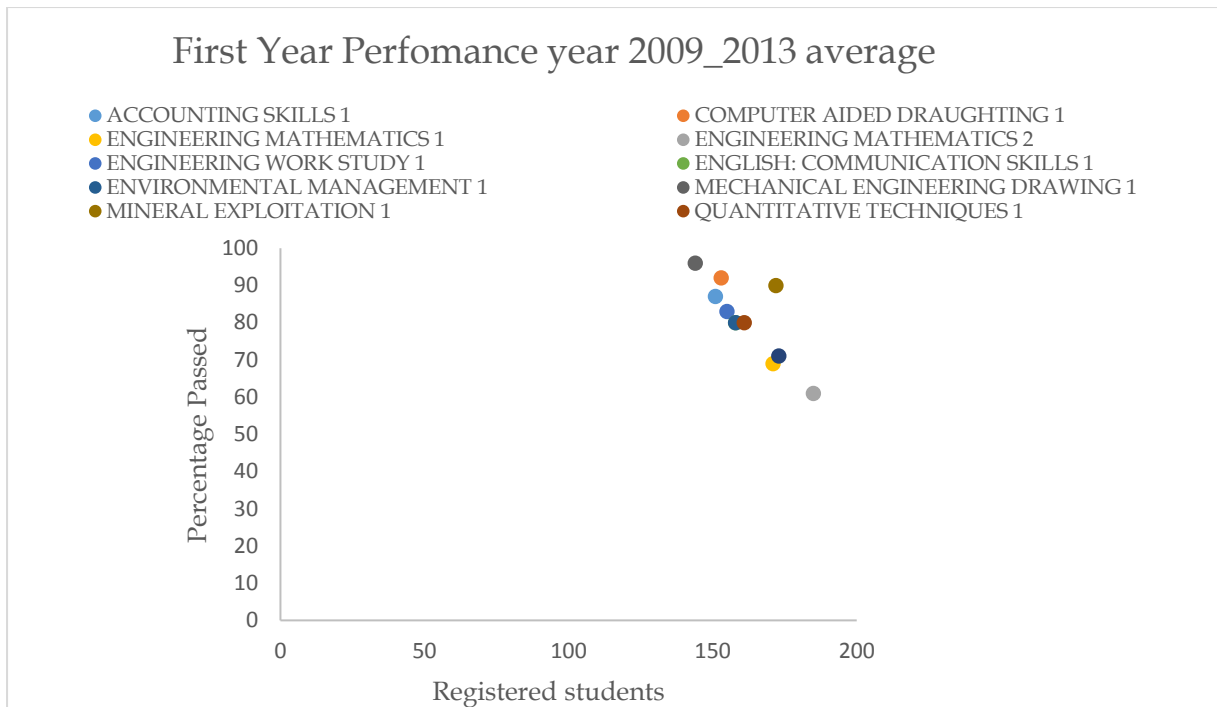


Figure 1.3 Percentage students passing various modules average for the year 2009 to 2013

Some students drop out because of the challenges they perceive when trying to find practical work P1/P2 programme. Over and above these reasons, the financial difficulties have been one of the reasons why students drop out and this is supported by the prevalent national strikes “Fees must fall campaign”. Some students have to drop out and find work, the bursary funding is not as common as it was in the past. A percentage drop out increased when enrolments were high in the year 2012. Some lecturers made comments that large classes are difficult to control and the one on one with students is lost by the lecturers. The use of cellphones in class has also increased in past five years and more so when a class is large.

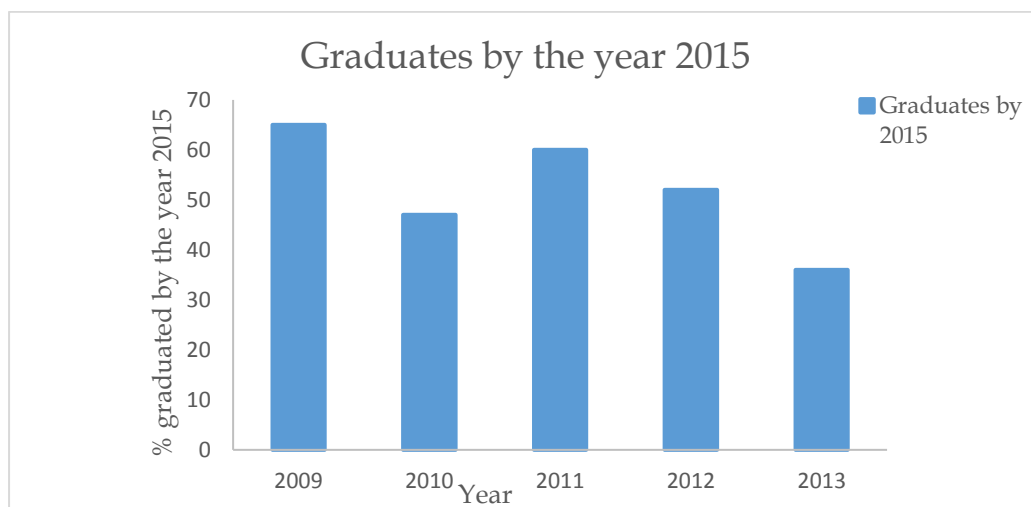


Figure 1.4 Number of students who graduated by the year 2015 in Mining Engineering National Diploma.

On average it takes at least 7 to 9 years for 60% of students enrolled in a single cohort to graduate for the mining engineering national diploma as shown in Figure 1.4. This finding is similar to what the Engineering Council of South Africa (ECSA, 2011) found, where they state that fewer than a third of all engineering students in Bachelors programmes graduate within the regulation time, and under two thirds graduate within six years .Several reasons were given for this by both students and academics interviewed. One such reason from students is that, they find modules that require strong mathematics more challenging than other modules. The students also mentioned that the time allocated for some of their priority modules is not enough. A reason given by academics is that, students fail to master some priority modules which then block them from proceeding to the next level of study. Promotion from one level to the next occurs when the student passes more than 60% of the modules in a particular academic year. In view of the phase out of the current diploma and the difficulty facing the industry in providing P1/P2 (2nd year), the opportunity has been given to attend S3, S4 (3rd year) without the P1/P2 from the start of 2015.

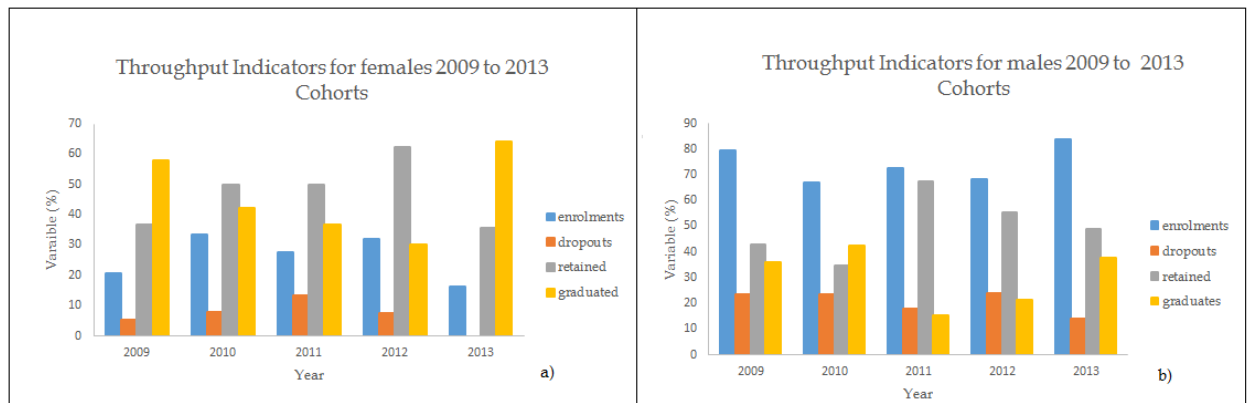


Figure 1.5 Throughput Indicators 2009 to 2013 cohorts Mining Engineering National Diploma

For all cohorts there are more males than females that enroll for the mining engineering diploma. This may occur due to the historic belief that mining is suitable to males because males are physically stronger than females. This may also be attributed to females not being attracted enough by the mining occupation as a whole. This assumption is still to be investigated further. Though not included in this analysis of the 90 students enrolled in the year 2016, 16% are females and 83% are males therefore this scenario is continuing to date. It can also be observed that there are lesser dropouts on females than in males. From Figure 1.5 it can be seen that on average 7% of enrolled females drop out from their studies while 20% males dropout.

### 5.1.2 Student grouping by gender, ethnicity and age

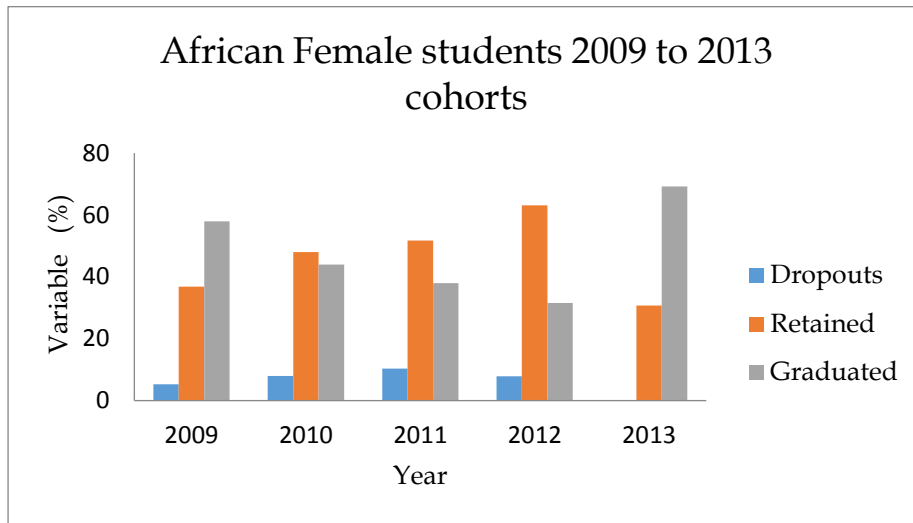


Figure 1.6 African female students 2009 to 2013 cohorts Mining Engineering National Diploma

Figure 1.6 shows that of the number enrolled for African females on average 46% are retained. A very low number of drop outs is observed on average 6% African females dropout. Almost 95 % of females are African in the Mining Engineering National Diploma and a small percentage is International.

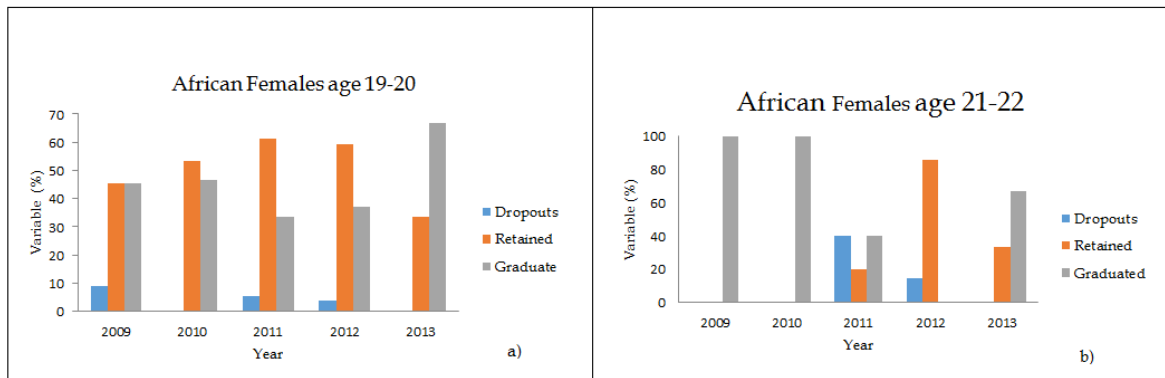


Figure 1.7 African female students ages 19-20 vs ages 21-22

Approximately 60% of the females are between ages 19 and 20 and about 20 % to 30% are between ages 21 and 22. It can be seen in Figure 1.7 that on average 46% of African females between ages 19-20 graduate. It can also be observed that of the number enrolled for African females between ages 21-22 almost all the students graduate, except in the year 2012, where a high percentage was retained. This age group is believed to graduate the most because most of the students are fresh from high school and they can easily grasp course content.



Figure 1.8 African, International and white males 2009 to 2013 cohorts

For males a rather different scenario is observed, though on average there is a high percentage of African males approximately 86% there is also a significant percentage of International and White males. The enrolment of International (non-South African) males is seen to decrease over this five year period. A decline in graduations and a rise in dropouts is seen to occur for International males. A high number of African males are retained and a steady rise in graduations and decrease in dropouts is observed. Taking the white males into consideration, there are fluctuations in graduations, however a very low dropout rate is observed. The decrease in the enrolment of International male students can be attributed to some countries not sending their students to South Africa any longer, such as Botswana and Mozambique. These countries have established their own mining colleges and actually teach their own students instead of sending them to South Africa. The period in question is when the global economic meltdown hit many countries including South Africa, thus less International students afforded to come to study in South Africa. A study done by the University of Johannesburg on the overall performance of UJ students comparing race shows that differences in students' performance is significantly different in the first year of study and becomes the same as the years increases (second and third year). The reason for this trend is due to the fact white students generally come from better performing high schools and tend to cope better with first year. However as the years go on both white and black students at UJ perform the same because of the support given to students (personal communication Meyer, 2016).

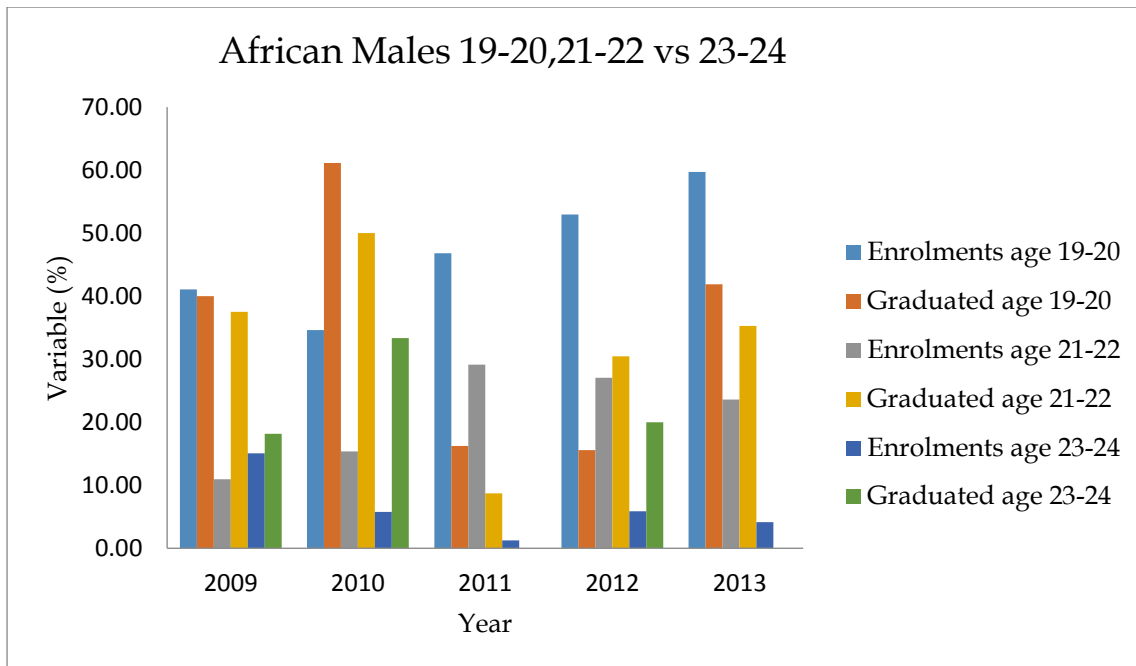


Figure 1.9 African females ages 19-20, 21-22 vs 23-24

In Figure 1.9 it can be seen that, the African males age 19-20 seem to be graduating more than all the other ages and they constitute the highest number of students enrolled. Similar reasons given for females possibly apply for males. The older students struggle more with S1, S2 which constitutes of mathematics and science, this is attributed to them having worked for a long time in the industry and have lost touch with their basic sciences.

## 6. Analysis from interviews

### 6.1 The students' perspectives

The interviews conducted with the students to try and understand what could be influencing their performance were classified into three main categories, this was done due to common responses obtained from the interviews. The categories are as follows.

1. The reasons for doing mining and choosing to study in UJ
2. The reasons for dropouts or failure
3. The culture of the Mining Engineering Department and the University of Johannesburg as a whole

Most of the Mining Engineering students think that they will be paid a big salary as they enter or begin their career. The salary comes out to be the biggest drive and attraction for doing and choosing mining engineering. A significant number of the students also responded saying that the career opportunities and path of a mining engineer is very desirable therefore they were attracted to follow this career. A small percentage of the students chose to do mining engineering because they obtained bursaries while

they were still in high school and also because they are interested in the discipline. A very small percentage admitted that they have relatives or know people who work as mining engineers and those people have influenced them to enroll in mining engineering. Some of the first year students mentioned that the excellent marketing through presentations done by the MQA is what made them want to do mining engineering. It is clear that some of the students had no idea what mining engineering entails or others had no interest other than the idea of a big salary and production bonuses obtained by Mining Engineers.

The mining engineering students decided to enroll at UJ for a number of reasons, one being the fact that, the Mining Engineering Diploma is the only contact programme which requires lesser APS points than Wits and UP. Other students mentioned that UJ is more affordable than the aforementioned universities and also they chose UJ because of its location (Johannesburg). A high percentage of the students believe that they are obtaining a good, high quality education from the mining engineering lecturers at UJ. The diploma is vocational meaning it offers more practical, students feel they are obtaining a balance between theory and practical work. The students also mentioned that, they have observed the graduates from UJ, they are of good quality and they progress quickly in their mining career. The students think that UJ graduates are most sought after by the mining industry because of their strong practical background.

The mining engineering students listed a number of challenges in their diploma which they feel contribute to some of them having to dropout. A large portion of the students expressed their frustrations and discouragement in the attempt of finding practical work P1/P2. The workload for their national diploma is "too much", students feel some modules are not mining related and should rather be eliminated from the diploma or in the new BEng. Students explained in detail how tight their timetable is for both attending lectures and tests/exams, they described it as "exhausting". This has contributed to them not being able to manage their time properly and thus under immense pressure. Other students felt they are being honest when they mention that their learning skills and thinking capacity are not adequate for university level and that's what makes them not succeed and end up dropping out or taking longer to master their diploma. They explained that some of the lecturers' teaching styles are difficult to follow and their learning styles are just inadequate. Students spoke of the problem of adaptation, some students cannot cope with their course work, the lack of self-discipline others even mentioned substance abuse and peer pressure. Most students in the Mining Engineering diploma come from rural areas such as Limpopo Province and they find it difficult to cope with the lifestyle in the city of Johannesburg where the Doornfontein campus is located.

Further on the factors that contribute to student's success or failure, the students mentioned that there are inadequate resources to support them in their academic work at Doornfontein campus, the students mentioned that the library closes too early for them. The students singled out mathematics as a reason for their failure in first year. Other students mentioned that they dropout due to the fact that, when

they fail some modules their bursaries pull out (stop-paying for them) or due to exclusion. Almost all the students agreed that it is the financial difficulties that mostly affect whether they dropout or continue with their studies. A small portion of the students responded as saying that some students loose interest in the mining diploma, due to discouragement and they lose focus and thus fail.

The last category which is the mining engineering student culture, students agreed that they have a spirit of working together as a team. One of the responses is that they treat each other like colleagues working in a particular mine shaft, even the language they use is of that nature. There is a project called the “stairs project”, which is the first year physical and mental fitness programme where students are taught discipline by climbing stairs seven floors up and discipline is instilled. Students have responded that this culture is only peculiar to mining engineering students and has helped students to succeed in their mining engineering diploma.

## **6.2 The academics’ perspective**

The interviews conducted with the academics to try and understand their opinion on throughput rates were classified into three main categories, this was done due to common responses obtained from the interviews. The categories are as follows:

1. The reasons students choose to do mining and choosing to study in UJ
2. Factors affecting throughput rates
3. The changes in student intake and body

The senior academics responded saying firstly parents see engineering as the best career option so they encourage students (their children) to enroll in engineering diplomas or degrees. The academics agreed that the Mining Engineering Diploma has a lower than average APS score for acceptance therefore more students tend to qualify to do the diploma. The career opportunities also came out a major contributor drawing students to mining engineering and also the fact that they can get bursaries to study. Academics think there is a culture of caring for students at UJ and the phenomenal marketing done by UJ as well as the institutional reputation draws the students to UJ.

A number of factors were listed by academics that, students with accommodation close to the campus do better and succeed in their studies as opposed to students that commute to university. The argument is that students that reside in the university accommodation are fairly close to resources, have their peers close to them to study with and have more time on their hands to study instead of spending most of the time travelling. The backgrounds from where students originate also contribute to their success or failure for example, transition from rural to urban life and adjusting as well as adapting to the city lifestyle. The time management for students is a challenge, some students are unable to balance their studies and social life others lack self-discipline. Some students are engaging in political activities and neglect their studies leading to failure and exclusion. Academics have observed that students learning skills and thinking skills are not to the required level especially for mathematics. Students are seen to



focus on passing exams instead of understanding course content and how it can help them for their career.

Academics believe that a change in the entry requirements can significantly improve the throughput because the talented students can be hand-picked. The introduction of aptitude tests should be applied when admitting students for engineering diplomas or degrees to ensure that suitable students are admitted. Academics feel that nothing has changed in the manner in which the intake is done, except for the fact that before 2012 there used to be two sets of intake and now there is only one intake which is done in the beginning of the year. The student body is almost 95% African (Black South Africans). Though the university has tried to cater for needy and deserving students as well as putting programmes like the first year experience, there are still throughput rate issues. The classes are increasing by +/- 10% each year this is causing problems for lecturers trying to teach large classes. Very few academics agreed to the notion that students are being overloaded with course work, academics feel that students are not committed to their work enough and don't put their studies as first priority hence most of them are retained in a diploma for over seven years for one reason or the other. Though lecturers pointed out that financial pressures contribute to student failure, they did not see it as a major problem as much as students did. The academics do acknowledge the fact that mining companies are not handing out bursaries as much as they used to a decade ago.

## **7. CONCLUSION**

From the interviews key common factors were identified as the reasons for some students failing or taking longer to complete the Mining Engineering Diploma and in this paper they are grouped into socio-economic and basic education/student capability factors. Some students lack a strong mathematics and science foundation this is particularly observed in 2012 after Paper 3 of high school mathematics was declared optional and the implementation of the NSC. A number of students dropped out because they could not cope with their academic work. The throughput of the UJ Mining Engineering National Diploma is largely affected by the number of students that are retained and do not graduate in the minimum required time. Some students lack financial support, some of the first year students mentioned that they were unable to obtain bursaries despite their excellent matric results. It is quite clear that the throughput challenge is multi-dimensional, it is not simply a curriculum problem. Academics accept the fact that not all students can cope or are meant to be Engineers some can excel as artisans or in skills based disciplines and should enroll in the further education institutions such as TVET colleges. Though the Mining Engineering Diploma experiences some dropouts, it is one of the best performing departments in the Faculty of Engineering and Built Environment when compared to other engineering departments. It has a graduation rate of average 40% which is above the overall institution (UJ) with an average of 34% for 2009 to 2013 cohorts.

## 8. RECOMMENDATION

Student support at undergraduate level should be the main focus and form part of the curriculum to increase and improve the chances of students' success. The foundation year should be established to bridge the gap between high school education and tertiary education. This should assist students with upgrading their mathematics and science knowledge before they even get to first year S1, S2.

One on one interviews should be conducted with potential students before they enroll for the mining engineering diploma, so that students can make informed decisions regarding a career choice. This should improve the effectiveness of the student selection process.

The effective use of technology should be considered not only in open distance learning also in full time diplomas such as the Mining Engineering in UJ. Students have mentioned that they would like to see more current cutting edge technology incorporated in their curriculum. The university as a whole should look into this fact so as to improve student engagement in teaching and learning.

The bureaucratic processes should be relaxed a little for the failed modules that prevent students from doing the next level. It should actually be the students' decision whether they can or cannot take on more courses in a year.

Other lecturers have started weekend extra classes to try and support students to cope with their academic work. This has been seen to improve pass rates and thus positively impacts throughput.

The National Diploma in mining engineering is a vocational programme and thus produces diplomates which are inclined to production as opposed to design etc. It is therefore recommended that students which apply for this diploma are aware of that before enrolment. Students would really appreciate it if lecturers can issue assignments after test week and for lecturers to assist them with obtaining the P1/P2 practical work. The students would appreciate it if lectures could be more explicit in giving, announcing the prescribed course material.

Basic Education and Higher Education need to find a common ground, where they can meet each other halfway with regards to developing the students' capability. ECSA should take its rightful position and facilitate the collaboration of key stakeholders and role-players as it was stated to be a resolution in the first annual Engineering Summit held 22 September 2011.

The government and the mining industry should improve the support offered to mining engineering programmes in terms of funding and increased staffing, to handle the constant increasing number of students enrolling for mining engineering.

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