By Lynn Biggs, Dierdre Els & Gary Richards

Introduction

Nelson Mandela University (NMU)[1] is a public university in Port Elizabeth, South Africa with nearly 27,000 students. The NMU has recognised the need to improve the rate of and enhance student success. However, the NMU lacks a centralised student monitoring and tracking system for faculties and academic staff.

As part of the overall NMU initiative, the Faculty of Law identified the need to develop a student monitoring and tracking system to assist with the:

- monitoring of students' academic performance,
- flagging and tracking of students requiring development,
- development of trends amongst key performance indicators (KPIs), and
- timely identification of initiatives to provide support to students requiring support.

The Initiative

The Faculty of Law together with ICT Services designed and developed the RADAR System. RADAR is a comprehensive electronic analytical system for monitoring, tracking, managing and reporting on student performance. RADAR was designed in consultation with academics, ITS experts, institutional researchers, academic managers, student counsellors, and the staff responsible for academic and teaching development.

The RADAR system has brought together all disparate data sets, processes and initiatives into a comprehensive system and data set that provides meaningful and useful information in support of enhancing student success.

The RADAR system was developed to look in particular at test, practical and assignment marks instead of examination marks. This is to identify students who are struggling or who require development as soon as possible. An individual student page showing all the modules a student has registered for as well as his/her average marks per module was developed, alongside a page where the marks for each individual test, assignment and practical could be viewed by the authorised lecturer. Lecturers have the facility to email

[1] Proclaimed as Nelson Mandela University, in terms of Government Gazette Number 40090 of 23 June 2016.

the student directly from the monitoring tool, as well as to make comments and recommendations for a particular student.

Current databases:

The databases currently available at the NMMU include:

- **Test Marks** (ITS) – Any assessment, practical or test mark per student and paper written.

- **Matric Results, Schools** (ITS) – What Matric subjects the students completed, what school they attended as well the examination body and pass level (Degree or Diploma) they achieved.

- **Matric Subject Requirements for Application** (ITS) – This data provides the matric subjects required in order to be accepted into a specific programme, as well as the minimum and testing band APSs.

- **Admissions** (ITS) – Records the Programmes each student has applied for in a particular year, as well as the application stage.

- **Biographical** (ITS) – The biographical data of students, including their home and next of kin addresses, gender, race and so forth.

- **Co-Curricular Activities** (ITS) – Any achievements, awards and activities the students were involved in while at the NMMU.

- **Financial Aid** (ITS) – Information on whether the students have financial assistance or not.

- **Registrations** (ITS) – Contains what qualification and modules a student has registered for.

- **Timetable** (ITS / CelCat) – Each student's timetable, including possible clashes can be identified.

- **Student Accounts** (ITS) – The student's account. Only an indicator (Red/Green) as to whether the student has fees outstanding.

- **Residences** (ITS) – Contains on-campus and large off-campus accommodation that the students are staying in.

- **Exam Marks** (ITS) – Exam results for each student per module and paper written.

- **Graduation** (ITS) – Identifies graduates and their ceremony date and times.

- **Disciplinaries** (ITS) – Lists any disciplinaries against students. This is sensitive information so may need special permission to utilise this data.

- **Disabilities** (ITS) – Records student disabilities at the time of application. It is up to the Disability office to keep this information updated.

- **HEMIS** (MIS) – MIS department's HEMIS statistics for reporting to the DoE. For example, fte's and pass rates.

- **Venue Access** (Salto db) – Which buildings and doors each student has access to.

- **Printing** (Printing db) – Printing data for students. For example, where and what each student printed. Not needed for this project.

- **PMG** (SQL Server db) – Meal management system for students. PMG stands for "Payment Management Gateway", and is also used for the Architecture stationary shop.

System requirements

The Faculty of Law required a student tracking and monitoring system that would enable Faculty members (lecturers, Heads of Departments, Directors of Schools, Executives Deans, academic advisors, where applicable) to:

1. Schedule consultations with students
2. Propose Interventions, for example, refer them to Student Counselling, Supplementary Instruction, extra tutorials and so forth.
3. Add and view other lecturer's comments of the students
4. Receive appeals from the students
5. Track attendance. Upload attendance data from excel or csv file.
6. Send emails to students (personalised and not automated).
7. View the status of certain key performance indicators (KPIs) for their students.
8. Basic Reporting

Key Performance Indicators (KPIs):

Some of the KPIs identified by the Faculty of Law are:

- Application Matric Subject Requirements not met and/or APS low; (Split APS)
- Referred for testing with CAAR and CAAR development suggestions;
- High risk modules
- Dean's List (students with an average of 75%)
- VC Scholarships and underperforming
- Home language, school attended – (quintile schools);
- Co-curricular activities;
- Credits registered for;
- Substantive vs procedural modules.

The level of reporting and analytics required determines the sets of information to be used by the system. It may be necessary to develop additional systems to capture essential information not already available.

Navigating the RADAR System:

The RADAR system can be navigated easily using the standard windows mouse, tab or arrow keys, as well as navigation offered on mobile devices.

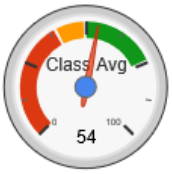
The layout of the RADAR system is divided into a high-level navigation such as Department, Qualifications and Modules.

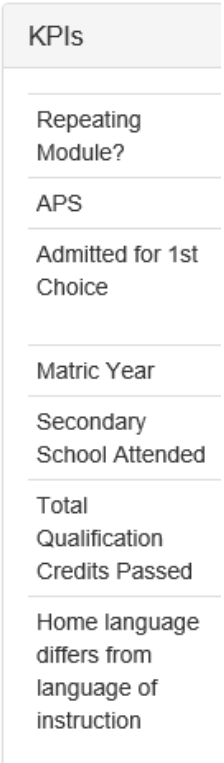
There are detail level options that appear depending on access levels and the current page being accessed –

Graphs, Comments and Email are available on the Module level, Biographical, Email, Comments and Class List is available on the Individual Student page and so forth.

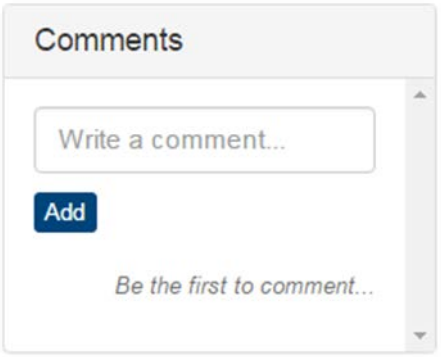
There is a drop-down list where users can select the relevant Module, Qualification or Department depending on the page they have navigated to.

The speedometer shows the student or class's overall performance based on Test, Practical and Assignment marks. There is a section where Key Performance Indicators (KPI's) are displayed. Other KPI's will be displayed as determined by the Faculty or Department.

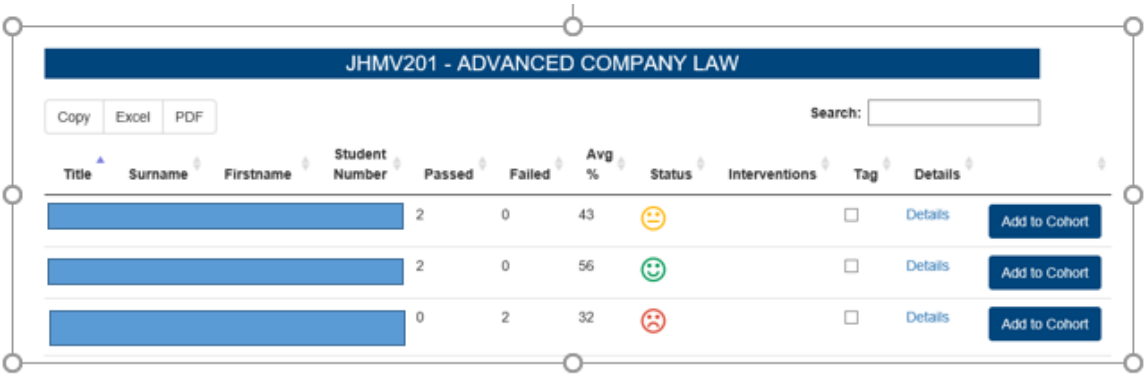




There is a facility for the user to enter comments per class or individual student.



A detailed section displays the results of the Department, Qualification or Module selection. This grid can be sorted by clicking on the column name, and previous and next records can be navigated to.



Any Blue text indicates a hyperlink and will take you to the next level of detail.

Each icon against a student has a different interpretation:

Excellent – Test, Practical and Assignment Average Marks greater than 74.9%.

Pass - Test, Practical and Assignment Average Marks between 50% and 74.9%.

Exam Entry - Test, Practical and Assignment Average Marks between 40% and 49.9%.

Fail - Test, Practical and Assignment Average Marks less than 40%.

No Data Available – No marks have been captured on ITS yet.

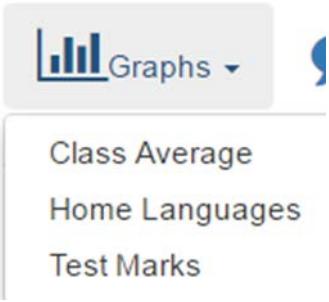
Exempt – Student has been exempted from this module.

The RADAR display is mobile friendly and will scale the layout to the window size of the device being used.

Reporting / graphs:

A number of graphs were developed to represent the KPIs. These are reflected as bar graphs, linear graphs, pie charts etc.

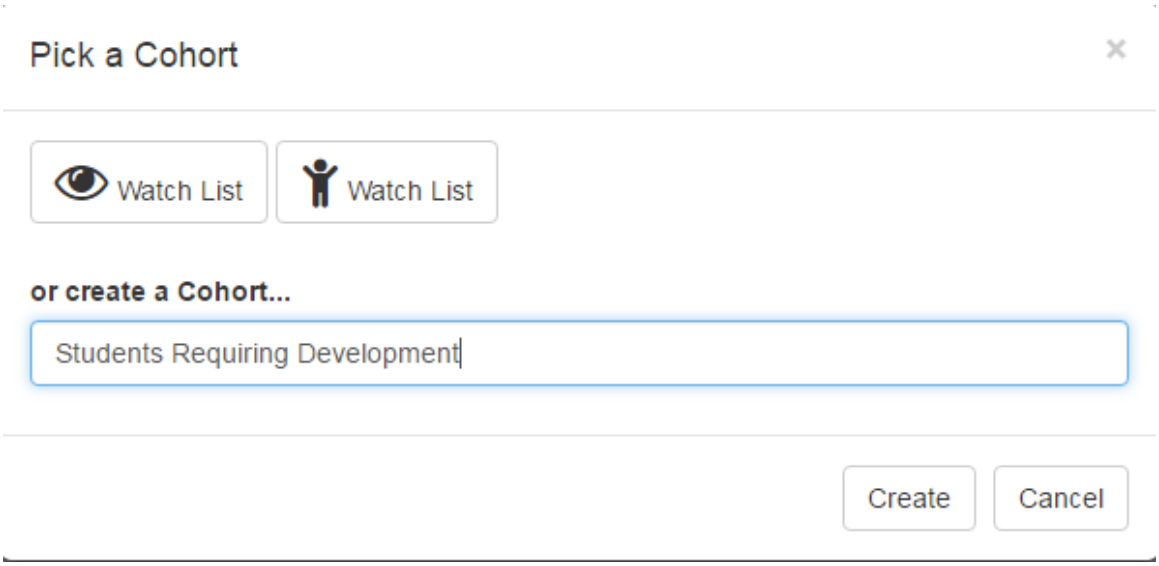
For example, graphs relating to “Class Average”, “Home Language” and “Test Marks” are available.



Cohorts and Cohort List

The RADAR system provides the ability for a lecturer to add students to a Cohort so that their progress can be tracked as a group. Students can be grouped into a Cohort from different Qualification and Modules. For example, VC Scholars or Bursary Students.

Each lecturer can create their own cohort, and add students directly from the Class List onto one of their Cohorts.



Interventions:

The RADAR system links to interventions currently available to students at the NMU. The intervention can be Faculty, Departmental, Module or Student specific.

These interventions include campus health services, the Disability Unit, ePAL (electronic peer assisted learning), financial aid, graduate and student placement, office for international education, student housing, supplemental instruction (SI), Library and Information Services (LIS), Centre for Teaching, Learning & Media (CTLM), Student Counselling, and Career and Development Centre (SCCDC).

An intervention can only be available for a specific Department, or for a specific Module code, for example Supplementary Instruction for specific Modules, or an intervention can be a university wide intervention available to all students, like Student Counselling.

Interventions

Create New

ID	Description	Active	Level	Code
1	Student Counselling - LEC Checklist	1	student	ALL
4	Writing Centre	1	student	ALL
2	Supplementary Instruction (SI)	1	module	JHM221
3	Supplementary Instruction (SI)	1	module	JHMV201

Access levels:

One of the challenges experienced with the development of the RADAR system was access control and the protection of the student's personal information. Therefore, the RADAR tool has been developed in such a way as to only allow a particular subject's/module's lecturers and HODs to see the respective information. Similarly, for the qualification and departmental level pages, HODs/DOSs and Deans are allowed to view the information.

Only HOD's and above can access the Biographical section due to the sensitivity of the student's personal information. The Biographical information of each student includes:

- The student's home, fee account, study and next of kin (NOK) addresses are given, as well as the Student Contact details like the cell number and email address.
- The residence the student is in, if any, is shown, as well as the international status, citizenship, home language and gender of the student.
- Education details for the student include the students APS score, matric subjects, school attended and year matriculated.
- Financial Aid the student is getting is shown in terms of the bursary code (no amounts). If the student has a Financial block against them resulting in them not being allowed to get their exam results, it will also be displayed.
- Any Administrative or Biographical Comments against the student are shown as this is where decisions regarding admission, registration and continuation of studies are recorded.
- CAAR recommendations are also shown against the student.
- Only the number of Co-Curricular activities the student is involved in are shown. The actual activities are not listed.

The access levels allow lecturers, HODs/DOSs and management to see the information per subject for an individual student or entire class. The information can also be scaled to qualification and department levels. The application used for the RADAR system is an interactive web form. The web form design follows a layered approach relevant at different levels of management and restricts access accordingly.

The levels of access include:

- HOD / Overall Qualifications Form
  The access to this form should be determined by whether the staff member is a HOD, and what department they have access to on ITS. They have access to the list of the qualifications for a particular department with the ability to drill to lower level from a particular qualification.

- Lecturer / Overall Modules Form
  The Lecturer or Module form's access should be controlled based on what modules the staff member is linked to on ITS. Lecturers have access to all the modules the staff member is linked to with the ability to drill to a specific module. KPIs at this level should refer to the overall success of the modules.

- Class Form
  The Class form should show all the Students within a particular module, with the ability to drill to a particular student. Access will also be at the module level based on the modules the staff member has been linked to on ITS.

- Individual Student Form
  The Individual Student form is the basis for the Student Monitoring and Tracking system from where lecturers can add comments regarding the student's progress, advise on and implement interventions and see whether the student is at risk based on KPIs identified. A list of all the modules that the student is registered for is available, with an indication of whether their test marks are above or below the cut-off percentage specified in the assessment mark criteria on ITS. This form will provide links to maintain consultations, interventions and add comments to a particular student. It allows email notifications to students and lecturers where necessary.

The case study

Introduction

The case study involves the analysis of the academic performance of students in one particular module. The module is a service module presented by the Faculty of Law to non-law students in another faculty (the Faculty of Business Economic Sciences). Students registered for the Bachelor of Commerce (Accounting), Bachelor of Commerce (General Accounting), Bachelor of Commerce (General accounting Extended) and Bachelor of Commerce Accounting Science degrees are required to complete the Advanced Company Law module. There are three module codes for the module, namely JHM221 (the old code which will be phased out), JHMV201 (the new code that was introduced in 2017), and JHM261 (George Campus code). This is a second year module that is presented in the first semester of the second year of study. The students are exposed to Company Law in the second semester of the first year of study.

The students doing JHM221 and JMHV201 are combined into one group and attend lectures together. However, their results are reflected separately under the respective module codes.

The module focusses on Company Law and in particular the Companies Act 71 of 2008. It is a detailed and intense module that sets out the complexities and intricacies of the Act. The module often presents as an obstacle to the non-law students registered for the abovementioned degrees.

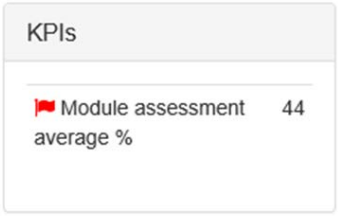
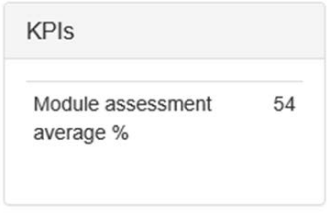
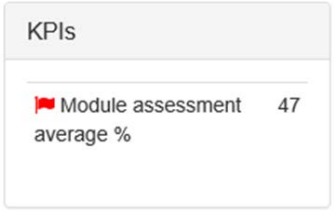
The results of the two assessments (before the examination) of all students registered for Advanced Company Law were to be analysed against the following KPIs:

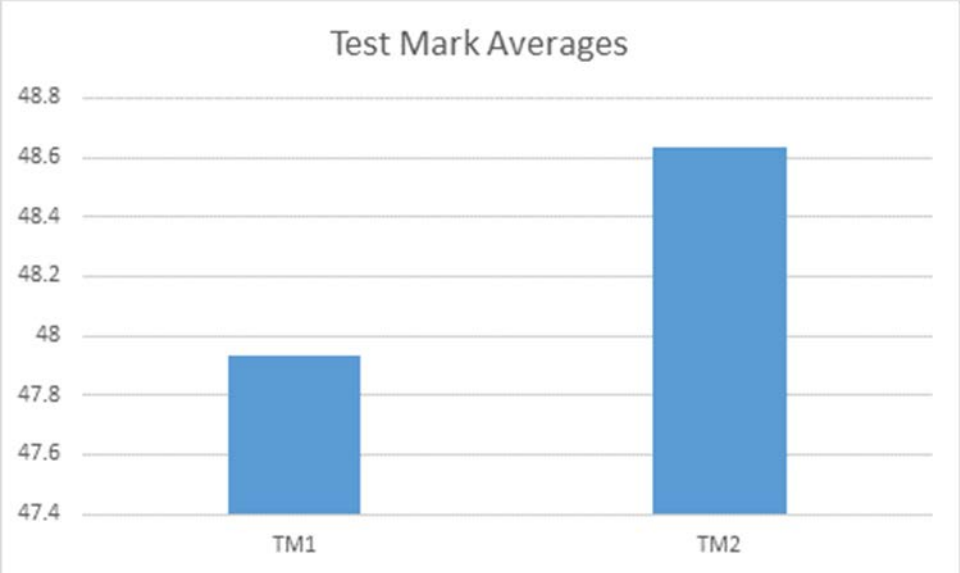
- Qualification type;
- Admission Points Score (APS);
- Language (especially if different from language of instruction);
- Repeating the module;
- Mathematics school result
- Mathematical Literacy school result

Results displayed on RADAR:

Class Averages:

The overall class averages were:

JHM221 **Old code (mostly repeaters)**	**JHMV201** **New code**	**JHM261** **George Campus**
 	 	 

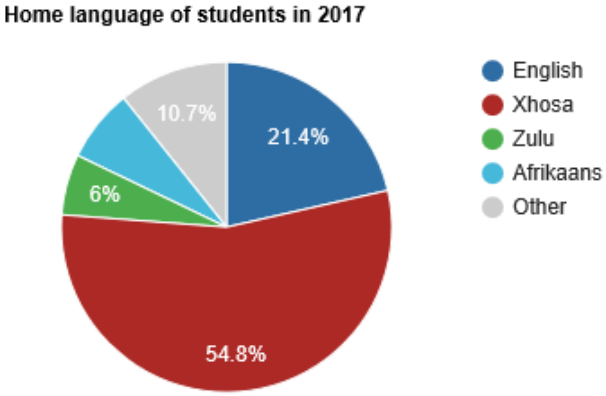


Home languages:

The home languages of the students can be broken down per module code as follows:

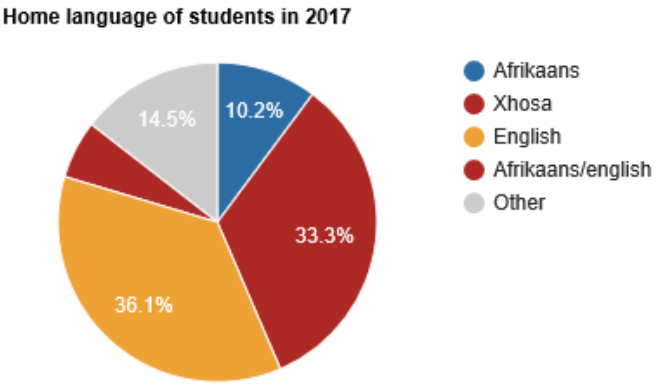
- JHM221 (Old code):

Total Students: **168**



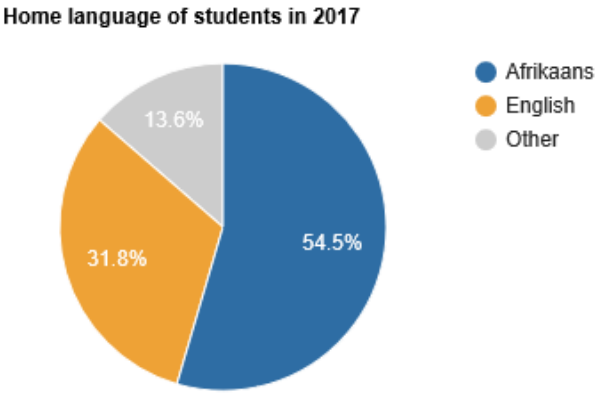
- JHMV201 (new code):

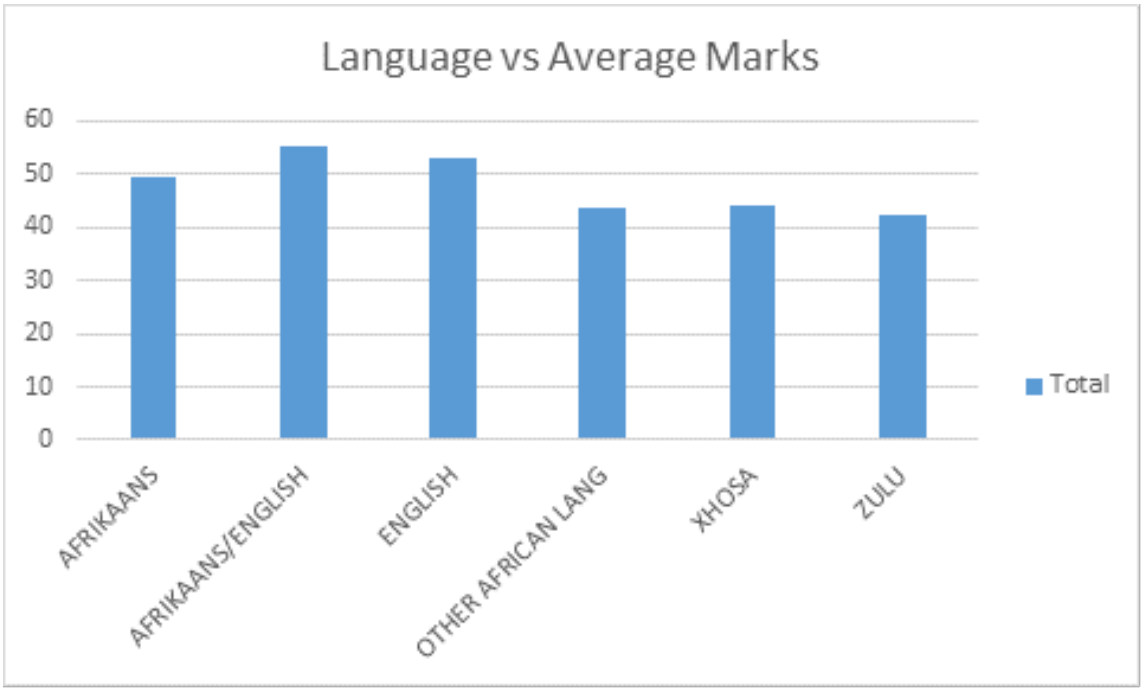
Total Students: **255**



- JHM261 (George Campus):

Total Students: **22**



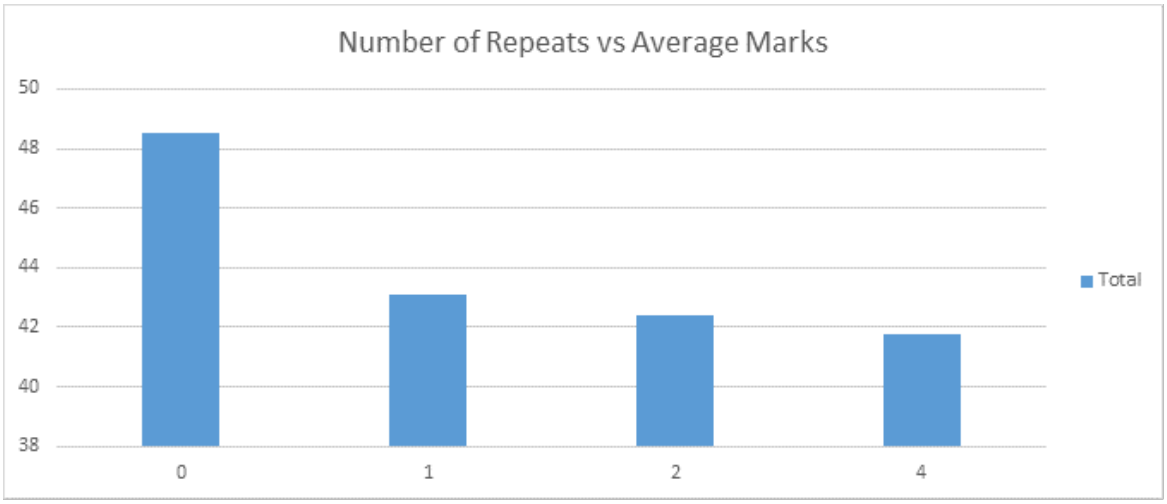


Repeat Students:

Students repeating the module would be registered for JHM221 (the old code) and JHM261 (the George Campus code) as JHMV201 was presented for the first time in 2017.

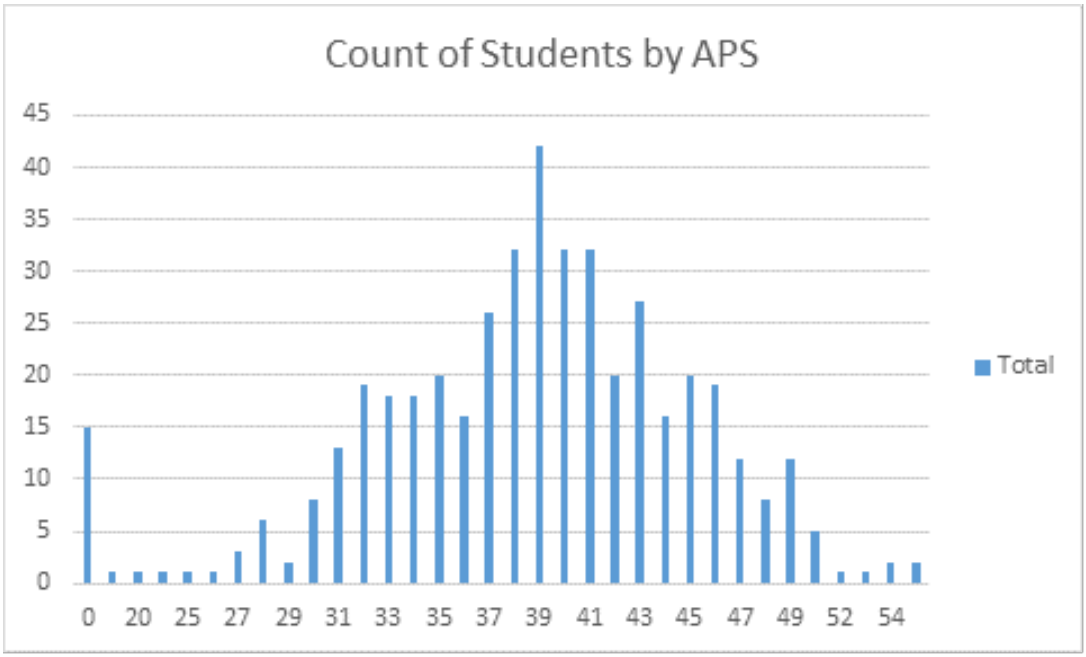
The number of students repeating the module 1, 2 or 4 times:

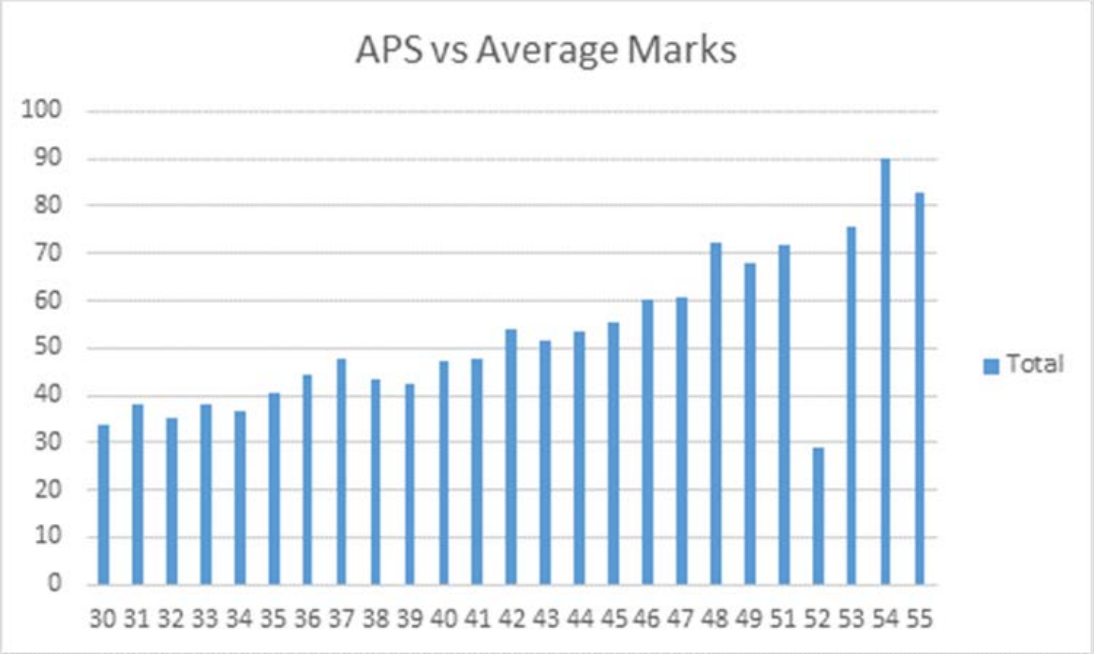
#Repeats	#Students
0	382
1	48
2	20
4	2



APS information:

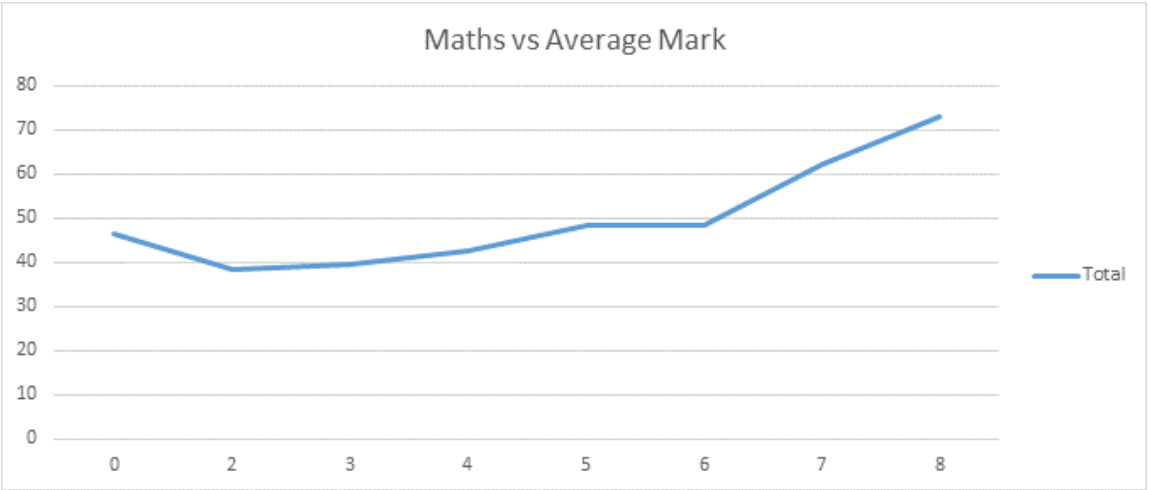
- An APS of 38 is an admission requirement.
- Students with an APS of between 30-37 are tested admitted (Access Assessment Battery.
- The average APS of students registered for Advanced Company Law was 42 in 2017.



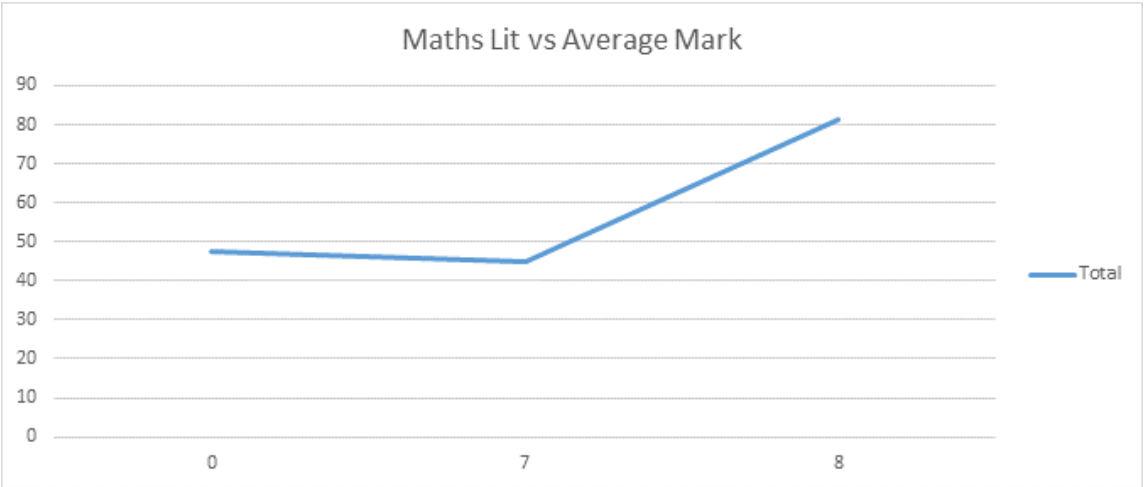


Mathematics and Mathematical Literacy

Mathematics:	
Matric Level	**Average mark**
0	46.5
2	38.5
3	39.4
4	42.7
5	48.3
6	48.6
7	62.4
8	73.2



Mathematical Literacy	
Matric Level	**Average Mark**
0	47.7
7	44.8
8	81.5



Analysis of RADAR Information

The following trends were identified after analysing the above information:

- There is a strong indication that an APS of below 37 has a positive correlation with the student's performance in the assessments. Students with an APS of above 42 have an average of above 50%.
- Students repeating the module have an average of below 44% as compared to an average of 48% for non-repeaters.
- On average the Afrikaans/English (bi-lingual) and English-speaking students perform better.
- Students with a Matric level 5 (60-69%) and below for Mathematics have an average of 48% and below.
- Students with a Matric Level 7 (80 – 100%) and below for Mathematical Literacy have an average of 44% and below.

Early warning triggers are:

- APS of 37 and below
- Repeating student
- Non-English speaking students (other than Afrikaans speaking students)
- Matric level 5 and below for Mathematics
- Any Mathematical Literacy student

Students meeting all these 5 triggers should be referred for remedial action as soon as possible.

Intervention suggested

15 students were referred to Student Counselling to complete the Learning Enhancement Checklist (LEC).

The LEC identified that the following issues could have impacted on academic performance:

- feeling under-prepared when started university studies,
- poor or inadequate time usage,
- incorrect learning styles adopted,
- not participating in class,
- not being able to express themselves in English (verbally during class or in writing during assessments,

- the lectures being too fast for them to understand, and
- lack of concentration in class or when studying

Issues around psycho-social aspects (such as feelings about themselves, depression, low self-confidence) could also impact on academic performance.

Systemic issues

Issues such as late registration and lack of a class attendance monitoring system possibly add to poor academic performance. Poor class attendance is of concern as less than 50% of the students attended lecturers in 2017.

Conclusion

The RADAR system was most useful when analysing the individual data for each student and the data per KPI. However, in order to identify trends, the data had to be analysed outside of the system. A development consideration for the RADAR system would be to link the system to a data analytics package.

Suggestions going forward:

- Students meeting the triggers (except the repeat trigger) are to be identified as early as possible (such as in the first semester of their first year) and referred for remedial action.
- Students meeting all 4 triggers at the beginning of the modules are to be referred for remedial action as soon as possible.
- Make use of support services, such as:
    - Presentation by Student Counselling on Neuro-psychology (to assist in understanding how their thoughts affect their feelings and their behaviour in order to empower them to take responsibility themselves) at the beginning of the module.
    - Presentation by CTLM (Centre for Teaching, Learning and Media) on study strategies specifically on how to study for this module at the beginning of the semester (either during class time or separate smaller session).
- An analysis of school quintile may be a more useful indicator than the language KPI.