FROM DATA ENTRY TO EVIDENCE BASED DECISION MAKING: HOW DATA AND ANALYSIS CAN DRIVE IMPROVEMENTS IN ADMISSIONS POLICIES

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BACKGROUND

Admissions policies and practices that are equitable, transparent and ‘fit for purpose’ are an important tool for maintaining and improving university academic standards. Part of ensuring quality teaching and learning outcomes, is the selection of a student body that has a reasonable chance of success. As such, it is a requirement within the “Guidelines for establishing Australian universities” which sit under the “National Protocols for Higher Education Approval Processes”, that each institution “has student admission policies and procedures which ensure that students are selected through open and fair processes and which are based on maintaining academic standards and maximising the likelihood of students succeeding in their studies” (Ministerial Council on Education, Employment, Training and Youth Affairs, 2007, 16). This requirement is further reflected in subdivision 19-35 of the Higher Education Support Act (2003, 24) which states that ‘benefits and opportunities must be available equally to all students’ and requires universities to select students on the basis of merit with scope to take into account educational disadvantage to ensure that values of social inclusion are also upheld (subdivision 19-35).

Academic standards and performance outcomes are also a major focus of the current Cycle 2 Australian Universities Quality Agency (AUQA) audits. AUQA has clearly stated that universities will need to provide “evidence of setting, maintaining, and reviewing institutional academic standards and outcomes” (2010, 27) and have released a framework to provide direction in how this can be achieved. Under the learning and teaching component of this framework, admissions policies and practices and their relationship with student academic performance have been highlighted. The focus is on entry requirements, processes for recruitment and selection, progress and retention of students and equity outcomes (2010, 95).

It is therefore increasingly important that universities have admissions policies that are transparent and well documented, support the making of consistent admission decisions and select those students that are the most likely to succeed.

This can be extremely challenging, particularly in a sector that draws upon a diverse range of applicants. For many institutions, particularly Monash where 35% of students are international (Department of Education, Employment and Workplace Relations (DEEWR), Higher Education Student Data Collection, 2009), applicants need to be assessed on the basis of a wide range of qualifications and tests.

Additionally, the Government’s response to the Bradley Review of Higher Education has been to encourage and provide opportunity for universities to grow and diversify through the setting of general and low socio-economic participation targets and through the introduction of “student centred funding” (DEEWR, 2009) which will effectively remove limits on the number of Commonwealth Supported Places. James, Bexley and Shearer (2009) have argued that to respond to this challenge, university’s will need to develop new student selection practices that utilise multiple selection criteria such as aptitude tests and interviews to supplement the use of Year 12 results. However, while growth is expected, any move to grow and diversify student populations through the use of new selection tools or other changes to admissions policies must not
compromise academic standards. As such, the Hon Julia Gillard, then Minister for Education, has explicitly stated that “if we have equity targets we must have quality targets” (2009).

Universities can only really ensure that their admissions policies maintain high academic standards if they have research and evidence to support their decision making. Institutions need to know what selection tools are best suited to their circumstances and aims and in particular understand how an applicant’s educational background relate to subsequent academic performance.

There is a vast range of literature that can assist universities in this decision making. For example, institutions wishing to review their admission processes in light of James et al’s recommendation to use multiple selection criteria can look to research into the predictive nature of Tertiary Entrance Ranks (ENTERS, now known as the ATAR) on university performance to better understand when the use of the ENTER may be optimal and when other tools might be more suitable. Some of this work suggests that the ATAR may best used for selection into highly competitive courses as ENTERS above 80 are strong predictors of university performance (Dobson & Skuja, 2005, 55) but within the 40-80 ENTER range there is a much weaker relationship (Murphy, Papanicolaou and McDowell, 2001). Similarly, universities are able to look to the work of Birch & Miller (2007) to be understand the predictive nature of aggregate ENTERs compared to individual subject marks, or to the analysis of Green, Brown & Ward (2009) to see how Year 12 science subject results relate to university performance in anatomy, physiology and biomechanics. This literature can inform decision making around the need for pre-requisite subjects or the usefulness of providing subject bonuses where the Year 12 subject curriculum is similar to the university course curriculum.

In the context of improving participation among students from disadvantaged backgrounds, research into relationships between selection tools, socio-economic status and academic performance may be useful. Work showing that Year 12 outcomes improve with socio-economic status (Birrell, Rapson, Dobson, Edwards & Smith, 2002, 14; James, Anderson, Bexley, Devlin, Garnett, Marginson & Maxwell, 2008), highlight the challenge of increasing participation among students from disadvantaged backgrounds when Year 12 results are the main selection tool. Similarly, research showing that Year 12 results can over reflect academic ability among students from independent schools (Dobson & Skuja, 2005, Naylor & Smith, 2002) can assist universities in finding ways to compensate for disadvantage. Similarly, the findings of McDonald, Newton & Whetton (2001) that selecting students on both the A Level results (ie Year 12) and the Scholastic Assessment Test (SAT) in combination might improve participation among students from disadvantaged schools can also assist universities in choosing new selection tools, while universities looking to develop new admission pathways can look to evaluations of Monash’s Diploma of Tertiary Studies (Levy & Murray, 2005).

While published literature can point universities in the right direction, differing applicant profiles, qualifications and backgrounds coupled with specific strategic objectives and course offerings mean that institutions should not just base decisions on external research. To enable best practice decision making institutions require their own internal data and analysis that is specific to their circumstances.

It is within this context that the University Statistics (US) department at Monash University, with the help and support of the Admissions Unit and International Recruitment Services, has developed a full suite of data that is used to develop, monitor and review Monash’s admissions policies. This paper will outline the work that has been undertaken in recent years from the collection of data through to analysis that provides evidence for strategic decision making. It is hoped that it will provide institutional researchers in other universities with ideas on how they too can proactively expand their suite of data to support important decision making.

IDENTIFYING AND FILLING THE DATA GAP
Around 2006, US identified a growing need for comprehensive, easy to access admissions data to assist senior management decision making. Requests for information on how the educational background of the university’s students related to their academic performance were increasing in number and complexity, but the data available to answer these questions were either not available or hard to access.

In the past, data provided to the unit by the Victorian Tertiary Admissions Centre (VTAC) had been sufficient. However a growing international student body (including overseas campuses in Malaysia and South Africa), and the development of direct pathways (eg the Monash College Diploma), a growing cohort of students were being admitted outside of the VTAC system. While the DEEWR student submission data provided some basis for admission data, it was clear that these files needed to be supplemented to allow for the analysis required.

This led to US conducting a needs analysis to identify gaps between the available data and the analysis needs of senior management. This work discovered that the following information were required but not readily available:

- English language pathway (eg IELTS test, previous studies in English) and score
- Previous qualification and relevant results (eg A Levels, university degree, TAFE diploma)
- Previous school/institution
- Key pathways such as Monash College, Monash University Foundation Year (MUFY)

Interrogation of the university’s student system (Callista) identified that key pathway data could be extracted as students enrolled in these programs were being recorded on Callista. However, data that would fill the other gaps were not consistently recorded on Callista and so processes needed to be developed to collect this information electronically.

With the assistance of the University’s central admissions unit, faculty representatives and International Recruitment Services (responsible for the admissions for most of Monash’s onshore international students), US commenced work on developing guidelines and a work instruction document for entering detailed basis for admission information onto Callista. This work included identifying exactly what data items were required as well as providing advice on where and how these data could be stored on the University’s student system to maximise data quality and accessibility.

When developing these guidelines a number of important considerations had to be made. Some of the key considerations were as follows:

- The costs of collecting each piece of data were weighed against the benefits. Data items were only made mandatory if it was foreseeable that it would be used for analytical or ‘auditing’ purposes.
- Data had to be collected in a form that required minimal ‘cleaning’ so, where possible, free text fields are avoided by ensuring adequate ‘pick lists’ are available for data entry staff.
- The collection of information was aligned with Monash’s admission policies to ensure that data are available to assess each key entry requirement.

As a result of this work, the University now requires that detailed previous qualification/basis for admission data are recorded on Callista for all direct coursework admissions. The following types of information are collected:

- Previous secondary qualification (eg type, score, country, school);
- Previous tertiary studies (eg level, institution, country);
- English language tests and scores; and
• Pre-requisite subjects.

DATA EXTRACTION AND PREPARATION

Once the issues around the collection of the data were resolved, US were able to tackle the task of pulling together all of the available data into one file that would allow for flexible and in-depth analysis. The most pressing requirement was for data on the admission pathway and subsequent performance of students starting a Bachelor’s Pass degree and so a Bachelor’s Pass admissions dataset was developed.

Most of the analysis and reporting undertaken in US utilise the Higher Education Student Data Collection files that are submitted to DEEWR (DEEWR data). The unit prepares two main files from these submissions: a unit of study file (i.e. one row per student per unit enrolment), and a course of study file (i.e. one row per student per course enrolment). These files are also supplemented with extra information about the course and the student including marks and grades.

Given this, it was decided to continue to use DEEWR data as the base for preparing a Bachelor’s Pass Admissions dataset. A complex extraction, transform and load (ETL) process was then written using SPSS syntax to merge in data from a range of sources including the VTAC masterfile, Callista admissions records and Callista enrolment records. Figure 1 below provides a diagram outlining where all of the data are sourced from and how they are merged into one file.
Figure 1: Data sources used in the preparation of the Bachelor’s Pass admissions dataset
Converting administrative data into a form that is clean and consistent and ready for analysis can be a difficult process as, unlike survey data, analysis is rarely its primary purpose. As a result, a number of hurdles arose during the development of the ETL processes. Common issues included:

- **Duplicate administrative records** (eg when a student has more than one previous tertiary qualification which one should be attached to the file?).
  - There is no set rule on the best way to de-duplicate administrative records. The answer must always lie in the purpose for preparing the data.

- **Free Text Fields**
  - Data collected in free text fields are almost impossible to statistically analyse as there is little control over the way categories are named/spelt (eg Monash vs Monash Uni, vs Monash University). Where possible, pre-set codes have been stored on Callista and staff are instructed to use these. If pre-set codes are not available staff are instructed to record the data exactly as written on any official documentation.

- **Inconsistent or illogical data**
  - Sometimes data entry errors result in data that conflicts with other pieces of information or simply appears illogical. For example, students recorded as having undertaken their previous studies in ‘Australian Antarctic Territory’ rather than in Australia. US feed these errors back to the University’s admission teams to improve the accuracy of the data entry and also build cleaning routines into the ETL processes to fix the more common mistakes.

Once all of the disparate pieces of information were merged together and the data cleaned, one final ‘academic admission pathway’ field was created using complimentary pieces of information (eg by comparing the DEEWR ‘basis for admission’ field with previous qualification type data). This was required to allow for analysis that could compare the academic performance of students admitted into the University on the basis of different qualifications.

The pathways identified in this field are as follows:
• Secondary Qual - VTAC
• Non School Leaver - VTAC
• Monash Uni Foundation Year
• Monash College Diploma - Part 1
• Monash College Diploma - Part 2
• Sth Africa Foundation Program
• Sth Africa Foundation Program & Non-award
• Previous Monash Uni Course
• Diploma of Tertiary Studies
• Single to Double Degree Transfer
• Australian Tertiary Qual - Direct Entry
• Overseas Tertiary Qual - Direct Entry
• Unknown Tertiary Qual - Direct Entry
• Other Aust Foundation Year - Direct Entry
• Other Overseas Foundation Year - Direct Entry
• Aust Secondary Qual - Direct Entry
• Overseas Secondary Qual - Direct Entry
• Unknown Secondary Qual - Direct Entry
• Other
DATA DISSEMINATION

US disseminate data to the wider university community through the use of excel pivot tables which is chosen because of its accessibility, and because of the flexibility it provides to ‘slice and dice’ the data.

The bachelor’s pass admission pivot table is published annually by US and contains an array of information, over a five year time period, about the current and previous study of Monash’s commencing bachelor’s pass students (see Figure 2 for a screenshot of the table). The table also provides users with a count of course enrolments, average marks, retention rates and progress rates. As a result, all Monash University staff members now have access to data that allows them to look at the following sorts of issues:

- Academic Performance by academic or English language admission pathway
- Patterns in pathways used over time or at different campuses/faculties.
- Relationships between previous qualifications marks/scores and academic performance in first year.
- Extent to which credit is awarded.
- Patterns of previous tertiary study - how many students have studied at university before? Which university?
- Gap Years – how many students deferred their offer prior to commencing their degree?

The wide scale availability of these data has many benefits.

- The need to rely on statistical specialists to provided data for admissions related decision making is minimised.
- Monitoring of admission pathways and subsequent academic performance can be readily undertaken at the micro level (eg at the course level by course co-ordinators rather than just at the faculty/university level). It also occurs more often because it is relatively easy to do.
- The data used by different areas of the University is consistent as staff no longer have to create their own ad-hoc reports from Callista (a transactional ‘moving’ system) to obtain these data.
Figure 2: Screenshot of Monash’s Bachelor’s Pass Admissions pivot table

ANALYSING THE DATA TO INFORM DECISION MAKING

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In addition to disseminating data, US also employs a Strategic Information Analysis team that undertakes statistical analysis and prepares reports of the findings to inform the decision making of senior management. This work is generally more complex in nature than can be undertaken using one of the published pivot tables. The team’s Manager also sits on the University’s Admissions Pathways Expert Advisory Group and the Coursework Admissions and Scholarships Committee (CASC) and therefore regularly draws on the Bachelor’s Pass admissions data to undertake analysis that supports these groups. Below are two examples of the analysis that has been undertaken and an outline of how this has informed decision making and lead to improvements in the University’s admissions policies and practices.

### SETTING OF ENTRY REQUIREMENTS FOR INTERNATIONAL SECONDARY QUALIFICATIONS

One of the core principals of Monash’s undergraduate admissions policies is that secondary level qualifications accepted for entry must be equivalent in standard to the Victorian Certificate of Education (VCE). As a result, before an international secondary qualification is approved for entry it must first be assessed against the VCE.

The approval process starts with the Admissions Pathways Expert Advisory Group which then reports to CASC. The group first undertakes a qualitative assessment of the qualification taking into account factors such as accreditation, curriculum covered, length of the course, entry requirements into the course and the marking system.

If the qualification is deemed equivalent in standard to the VCE, the group is required to make a judgement on how the scores from the qualification should be aligned against the ATAR score received by VCE students. This allows the University to set comparable entry standards for different secondary qualifications.

A reference table based on a banding system is used to set course entry requirements for students admitted on the basis of these qualifications. Each band is aligned to a particular ATAR range which is referred to when a band is assigned to a course. For instance, if the entry standard for a particular course is an ATAR between 70 and 74.95, the entry level is set at band 1. When a qualification is reviewed, its scores are then assigned across the bands with reference to the ATAR. In the example shown in Table 1, students admitted on the basis of ‘Qualification X’ would require a minimum score of 14 to gain entry to the course.
Table 1: Example of Monash’s undergraduate entry band framework for international secondary qualifications

<table>
<thead>
<tr>
<th>Band</th>
<th>ATAR</th>
<th>Minimum Qual X Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>65-69.95</td>
<td>12</td>
</tr>
<tr>
<td>1</td>
<td>70-74.95</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>75-79.95</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>80-84.95</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>85-89.95</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>90-94.95</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>95-97.45</td>
<td>23</td>
</tr>
<tr>
<td>7</td>
<td>97.5+</td>
<td>24</td>
</tr>
</tbody>
</table>

When a qualification is first assessed there are usually no quantitative data available to assign scores to each band, and so this judgement is made on the basis of the qualitative information available. However, after three years, each qualification is reviewed and the academic performance of students admitted on the basis of the qualification is examined. This allows for a statistical judgement of the qualification’s suitability as an approved admission pathway.

This assessment is first provided in the form of a basic ‘1 page’ report that can be prepared quickly. It gives a brief overview comparing the average marks and progress rates of students admitted on the basis of the reviewed qualification against VCE pathway students. See Figure 3 for an extract from the report prepared for the review of the GCE A Level.

If there is a significant and substantial difference in the academic of the two groups, it may suggest that the entry standards applied to this qualification need adjustment. In this case, and if enough data are available, regression analysis is used to calculate a score that is ‘equivalent’ to the ATAR.

This analysis was recently undertaken for the Ontario 12 qualification. The methodology uses linear regression to examine the relationship between the qualification scores and first year average marks and then between the ATAR obtained by VCE pathways students and their first year average marks. The linear equations resulting from this analysis are then used to calculate ‘equivalences’ between the qualification scores and ATARs. For example, if the analysis showed that Ontario 12 pathway students with a score of 70 obtained, on average, a first year average mark of 60. Then, by looking at the ATAR score that was related to an average mark of 60, it becomes possible to calculate the ATAR score that an Ontario 12 score of 70 is ‘equivalent’ to.

The analysis led to a change in the entry requirements applied to students admitted on the basis of the Ontario 12 qualification. As such, it is expected that there will be improved consistency in the academic performance Ontario 12 pathway students with those admitted on the basis of the VCE.
Table 1: Average marks (weighted) and progress rates for commencing bachelor pass students by basis of admission, 2005-2008.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Basis of Admission</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Mark</td>
<td>General Certificate of Education A Level</td>
<td>64.2 (204)</td>
<td>65 (247)</td>
<td>66.8 (291) *</td>
<td>66.1 (440)</td>
<td>65.7 (1182) *</td>
</tr>
<tr>
<td>Weighted</td>
<td>VCE/IB</td>
<td>63.4 (3579)</td>
<td>64.6 (3959)</td>
<td>63.9 (4154)</td>
<td>65.1 (3885)</td>
<td>64.2 (15577)</td>
</tr>
<tr>
<td>Progress Rate</td>
<td>General Certificate of Education A Level</td>
<td>89.5 (221)</td>
<td>89.5 (282)</td>
<td>91.5 (342) *</td>
<td>90.1 (508)</td>
<td>90.2 (1353) *</td>
</tr>
<tr>
<td></td>
<td>VCE/IB</td>
<td>87 (3743)</td>
<td>88.6 (4122)</td>
<td>88.3 (4343)</td>
<td>88.9 (4080)</td>
<td>88.2 (16288)</td>
</tr>
</tbody>
</table>

* Significantly higher than the VCE/IB students  ^ Significantly lower than the VCE/IB students  † No significance test, small numbers <2
Number of observations show in brackets

Figure 1: Average marks (weighted) and progress rates for commencing bachelor pass students by basis of admission, and managing faculty, 2007-2008.

Figure 3: Extract from international year 12 qualification review reports (GCE A Level)
VCE ENGLISH AND SUBSEQUENT ACADEMIC PERFORMANCE

Strong literacy and communication skills, both written and verbal, are an important prerequisite for students wishing to study at an Australian university. Without a strong foundation in English, the ability for students to learn and demonstrate their learning can be compromised. With the growth in international student numbers, the assessment of English language skills in admission processes has long been the focus of much debate. For instance, there has been criticism that, in 2005-06, about a third of successful permanent residence applicants who are former students in the Australian tertiary sector were not able to achieve an IELTS (International English Language Testing System) score of 6 (the band classified as ‘competent’) (Birrell, 2006), raising questions about the English admission standards within universities. Additionally, the Victorian Auditor General’s 2002 report ‘International students in Victorian Universities’, which was based on an audit of three universities including Monash, noted that ‘a significant proportion of university staff have concerns regarding the English language proficiency of international students’ (2002, p 4) and noted that this may be due to selection processes that allowed some students to bypass tests of English language by entering through a different pathway. An earlier review of university English entry requirements by Coley (1999) supported this conclusion finding that there were at least 61 ‘English language pathways’ accepted across the Australian sector ranging from ‘stringent’ tests such as the IELTS, to measures that arguably have little validity in terms of the English required for university studies such as ‘membership of a professional body’. Coley also concluded that English admission policies in the sector are ‘based on secondary information and administrators are generally not familiar with the actual tests themselves’ (2009, 9).

Given this, US have prepared a number of reports examining relationships between the pathway used by students to satisfy the University’s English language requirements and their subsequent academic performance.

One piece of work in particular has driven change both internally and externally. Analysis undertaken by US in 2005 comparing the academic performance of domestic students with their international counterparts highlighted that international students who had completed the Victorian Certificate of Education (VCE) were performing at a much lower level than other students both domestic and international. This seemed surprising given they had already been studying in the Australian education system and might arguably be better prepared for University studies in Australia than other international students recruited from offshore.

Further investigation showed that the vast majority of these students had satisfied the English requirements of the VCE by completing a subject called English as a Second Language (English ESL), rather than the other English subjects undertaken by native English speakers. At the time, the minimum English score required by VCE pathway students into the University was a 25 in English (or 30 for some courses) and this applied to both the standard VCE English and the English ESL subject. Analysis was then undertaken to compare the average marks achieved by students who had studied English ESL with those who had studied the standard VCE English subject. The work found the average marks of English ESL students were much lower and that only those who achieved a study score of about 40 or more (out of a maximum of 50) were performing on the same level as those who had studied the standard VCE English subject.

Given the importance of these findings for the Victorian education sector, the findings were also communicated to VTAC who responded by convening a working party to examine the issue further. Using regression analysis to examine relationships between English and English ESL scores and results achieved by VCE students on the Written Communication component of the General Achievement Test, it was found that, to be equivalent to a standard English score, an English ESL score had to be between five and seven points higher (VTAC, 2007).
This work led to a change in the University’s English Language policy and so students who have studied English ESL in their VCE are now required to have a minimum score of 30 (compared to 25 for the standard English). Other universities such as the University of Melbourne, Deakin and Latrobe also followed suit (The Australian, Dec 2007). The new requirements have been in place for two years now. While some preliminary work has been undertaken to evaluate the impact of this change on levels of academic performance, it is too early to make solid conclusions as only one year’s worth of results are available at this time. A detailed assessment will be undertaken in 2011.

CONCLUSION

Access to comprehensive and accurate data and insightful analysis is an important pre-requisite for effective decision making in any organisation. Universities are not exempt from this. The recent emphasis on widening participation and the changing funding arrangements resulting from the Bradley Review, means that it is more important than ever that institutions can respond quickly to change through evidence based decision making. Additionally, cycle 2 AUQA audits will require institutions to closely monitor and review their academic standards - work that can only be undertaken if the institution’s student data quality is of a high standard.

At Monash, it became apparent that one of the major gaps in the University’s suite of data lay in the lack of detailed admissions data. Decisions about appropriate entry requirements for the University’s courses had to be made without sufficient quantitative data, or were being delayed waiting for data to be collected and prepared on an ad-hoc basis.

In response to this, US embarked on a long journey of data collection, preparation and analysis to fill this gap. Approximately four years on from the commencement of this work, Monash has a substantially greater understanding of the educational background of its student body and how this relates to performance within its degrees. Senior management are much better placed to make decisions about changes to its admission policies and recruitment practices and can better judge what the impact of these decisions might be. Requests for analysis that might have taken months to complete in the past, can now often be completed in a matter of days.

While the availability and accuracy of admissions data has improved immensely, the work is ongoing and has also been picked up by other areas of the university. In early 2010, the admissions unit, the student systems team and the University’s Business Intelligence team worked together to incorporate extra ‘basis for admission’ codes into Callista. This means that if a student enters through a key pathway such as the Diploma of Tertiary Studies (DOTS), the selection officers can select ‘DOTS’ as the basis for admission rather than simply using a generic ‘complete or incomplete higher education course’ code. This will streamline the processes used to categorise students into admission pathways and will also improve data accuracy. Additionally, plans are underway to improve access to Year 12 subject data so that analysis can be undertaken to examine the relationship between individual year 12 subjects and university performance. This work will assist the University in assessing the role of pre-requisite subjects in entry requirements.

The constantly changing and evolving nature of higher education in Australia will challenge university statistics units to be increasingly pro-active in meeting the data needs of senior management. It will be necessary to expand the scope of available data and to ensure that it is flexible enough to respond to shifting requirements. While there are common themes and issues facing all universities across the sector, each institution will have its own specific requirements for information and analysis and will dedicate varying levels of resources to this task. However, it is hoped that this paper, and its description of the process of developing and utilising
admissions data to inform decision making, will provide other institutional research with ideas on how they can effectively respond to these challenges.
REFERENCES


Higher Education Support Act 2003 (Cwlth)


