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Team
- ✓ **Ambassador-** Sevara Naidoo- student
- ✓ **Data Analytics**: Mr Alpheus Mahoya- student
- ✓ **Lecturers**: Ms Tessendorf (co-ordinator); Syden Mishi, Ms Kholofelo Hlungwani (George), Ms Lana Erasmus (Assistant)

Use of Technology for Inclusivity and Improved Learning on Intermediate Macroeconomics

Presenters: Ms Sharon Tessendorf and Prof Syden Mishi

Introduction

- Prior research suggest that approximately 41% of first-time South African undergraduate students registered for three-year qualifications will never graduate (CHE, 2013:45)

  - approximately 47% of students who enrol at Nelson Mandela University never graduate (NMMU, 2010)

  - Any hurdle need to be attended to

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Introduction

- Reasons explaining poor success rates
  - The **secondary schooling system** in South Africa (see e.g., Maddock & Maroun, 2018; Nkosi, 2015; Van Broekhuizen, Van der Berg & Hofmeyr, 2017),
  - The use of **English as a learning and teaching medium** (Steyn, Harris & Hartell, 2014; Van Rooy & Coetzee-Van Rooy, 2015),
  - **Numeracy literacy** (Kilfoil, 2015),
  - Comfort with **educational technology** (Kilfoil, 2015),
  - The ability to adapt to **independent learning** (Kilfoil, 2015),
  - **Socio-cultural factors** also play a role in students' academic success (CHE, 2010; Kagee, Naidoo & Mahatey, 1997:249),
  - The "short supply of and access to both prescribed and recommended textbooks" (Iwu & Xesha, 2011:87)
  - Lack of data, in general or on specific metrics to the lecturer and other stakeholders

Learning analytics

A decade ago, Picciano (2012) argued that it was already becoming common for tertiary education institutions to use data analytics to address challenges such as improving student performance, outcomes, and persistence.

So, what's changed in that decade?

- We know more about learning
- There has been an explosion of online educational platforms
- New forms of data about learning (Teasley, 2016)

Learning analytics
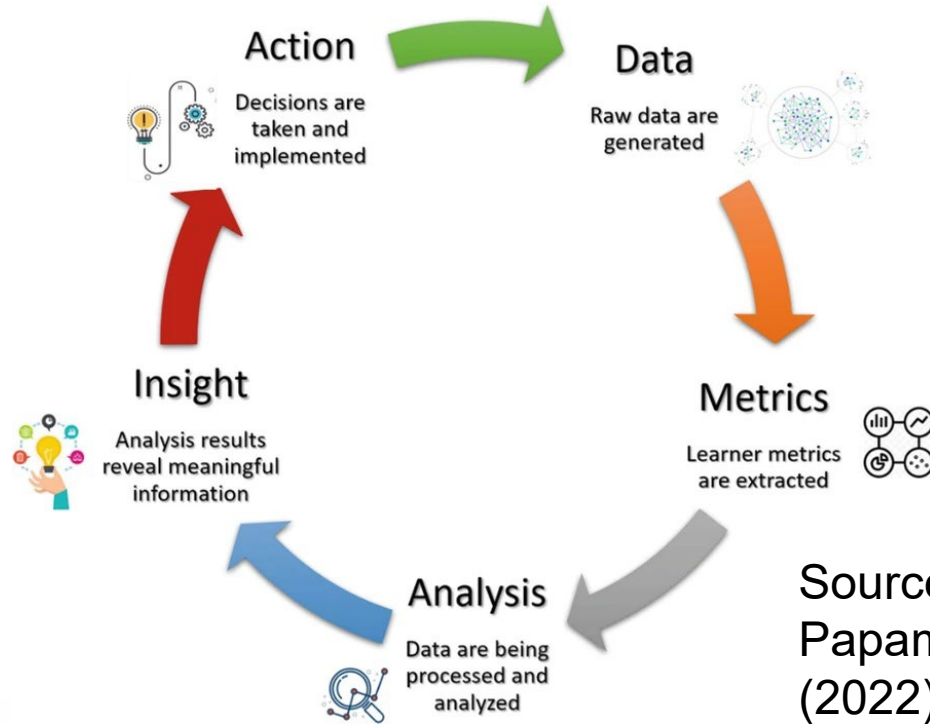
Learning analytics is the:

measurement,

collection,

analysis, and

reporting of data about students and their context to understand and optimise learning (Abed & Dalbir, 2020; Nguyen, Gardner & Sheridan, 2020).

Analytics aids in the development of personalised instruction models, the mapping of learning domains, the evaluation of learning support provided by a learning management system (LMS), and scientific discovery about students (Baker, 2010).
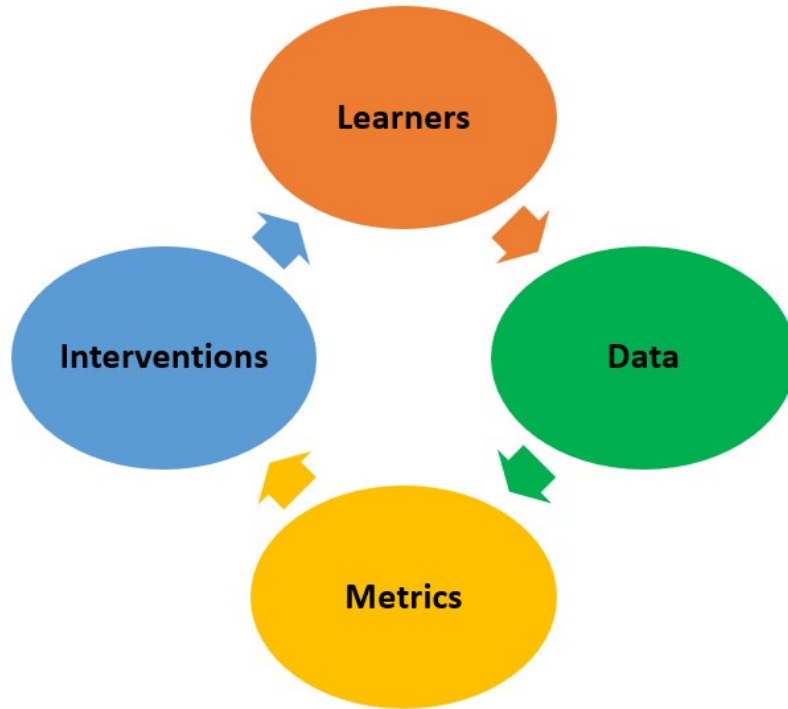
Data analytics framework
Campbell and Oblinger (2007)

Source: Mougiakou, Vinatsella, Sampson, Papamitsiou, Giannakos & Ifenthaler (2022)

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Data analytics framework

Clow (2012)

Source: Clow (2012:134)

Learning analytics

In the process of learning analytics, both learner and contextual data are required.

To illustrate, consider the following simple and generic example.

How many views are required for an educational YouTube video to be considered successful?

That is the number of views a video you posted received.

If one is measuring something but not necessarily all of the right things, the end result may still be incorrect, or one is relying on incorrect data to make the case.

This is what distinguishes data from metrics.

The case

Intermediate Macroeconomics Module

Regional decomposition of reg. students
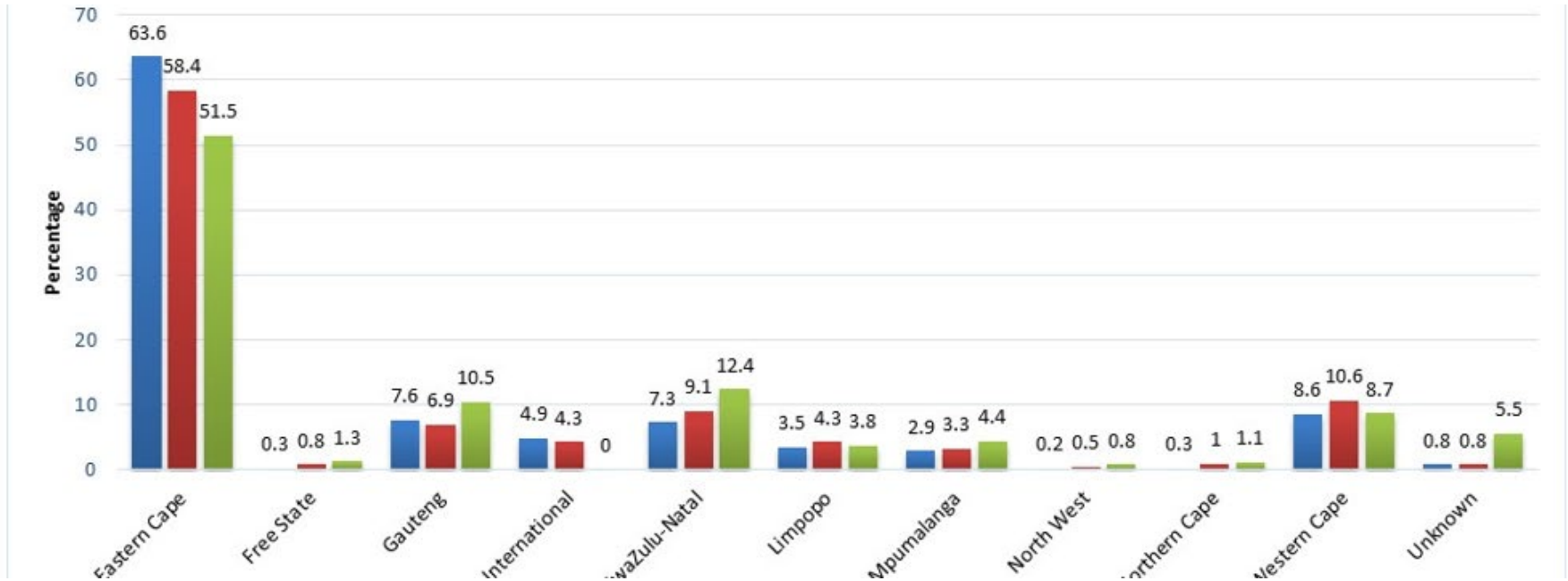
Enrolled students by population group
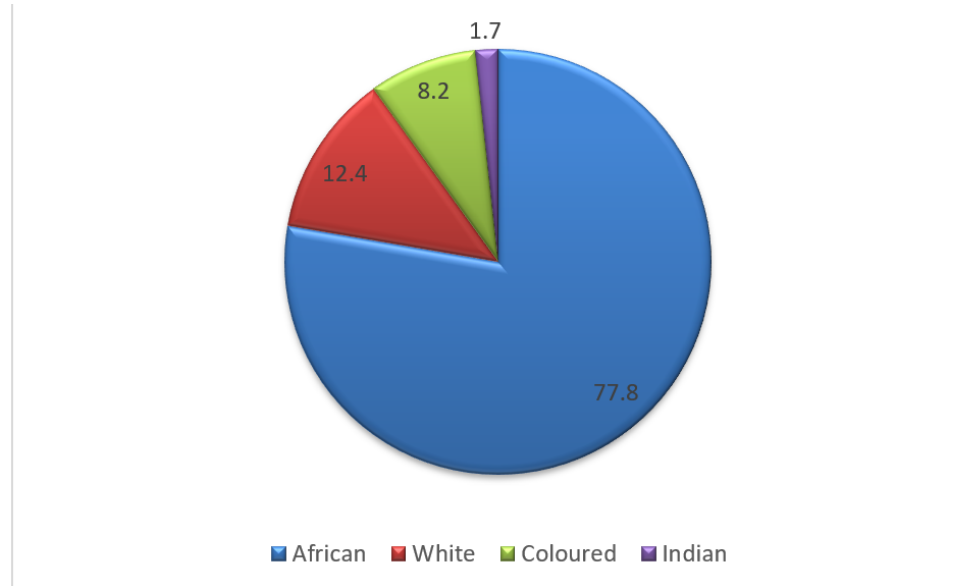
Source: Nelson Mandela University (2022a)

Home language of students
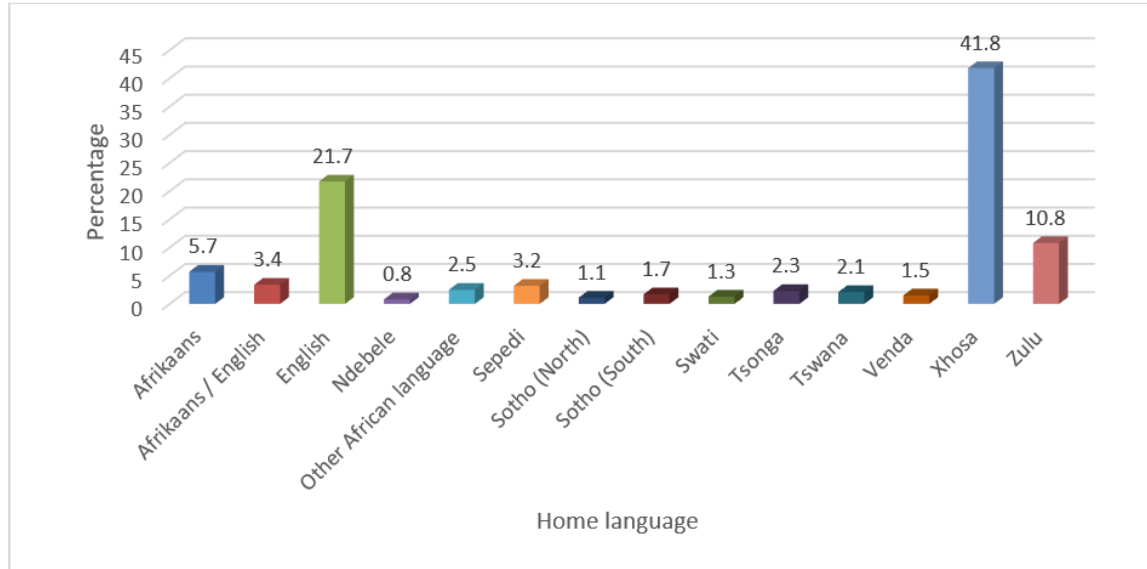
Source: Nelson Mandela University (2022a)

Consolidated pass rate- 2016-2021

Source: HEMIS (2022)

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Theory of Change

Higher failure rate; clogging: no access to key resources, not able to measure engagement with key text

→ Need Assessment

Achieve Platform: access to key text + activities

→ Intervention

- Have the prescribed text enables learning
- Engaging with content improves learning –success
- Self monitoring instills sense of responsibility
- Able to monitor key metrics on a module helps identify appropriate teaching strategies

→ Assumptions

- Increased reading of key text
- Success on formative assessments

→ Intermediary outcomes

. Increased pass and overall success rate

→ Outcomes

The design

- Target group/ recruitment
  - 2nd year degree students [Module: Intermediate Macroeconomics]
  - Every student provided with access to Achieve
- Quasi- Experimental design
  - Control: None [those who did not take up, but …] – unique characteristics
  - Encouragement design
  - Compare before and after
  - General weakness to make overall claim, but noticeable improvements

Achieve

MacMillan Learning's *Achieve* learning management system, which is fully intergratable with Moodle, combines an integrated e-book, which is searchable and downloadable, with robust homework and fully digital end-of-chapter problems, including Work-it-Outs (MacMillan Learning, 2022).

Targeted feedback addresses students' misunderstandings and responds to students' incorrect responses.

Through the LearningCurve technology, *Achieve* provides personalised question sets and feedback is based on each student's correct and incorrect responses (MacMillan Learning, 2022).

Achieve

The built-in Gradebook provides lecturers with a simple and easy-to-use platform for viewing class performance and individual students' performance.

Individual evaluation's results can also be viewed (MacMillan Learning, 2022).

It has been postulated that these analytics could help students more accurately gauge their progress and, where necessary, adjust their learning practices (MacMillan Learning, 2022).

Analysis

The data set for each student comes from two main sources, namely the student information system and the learning management system (both Moodle and *Achieve* were used).

The former gives access to student personal data, such as race, gender, nationality, and AS scores.

From the last source was extracted information about student's online activity within the aforementioned tests but also regarding the student's overall engagement in terms of time spent on the course material and in terms of login frequency.

Adoption of Achieve

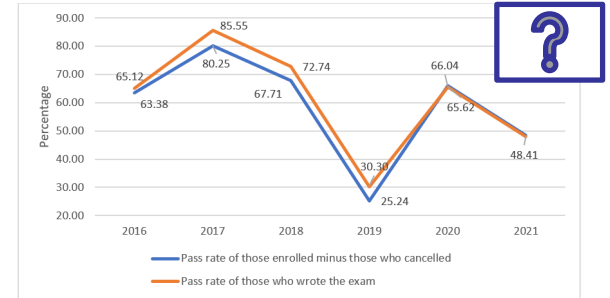|	
49.6%	Percentage of African male & female students who accessed Achieve
69.2%	Percentage of White male & female students who accessed Achieve
51.2%	Percentage of Coloured male & female students who accessed Achieve
66.7%	Percentage of Indian male & female students who accessed Achieve

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Within Achiever Success: Adopters
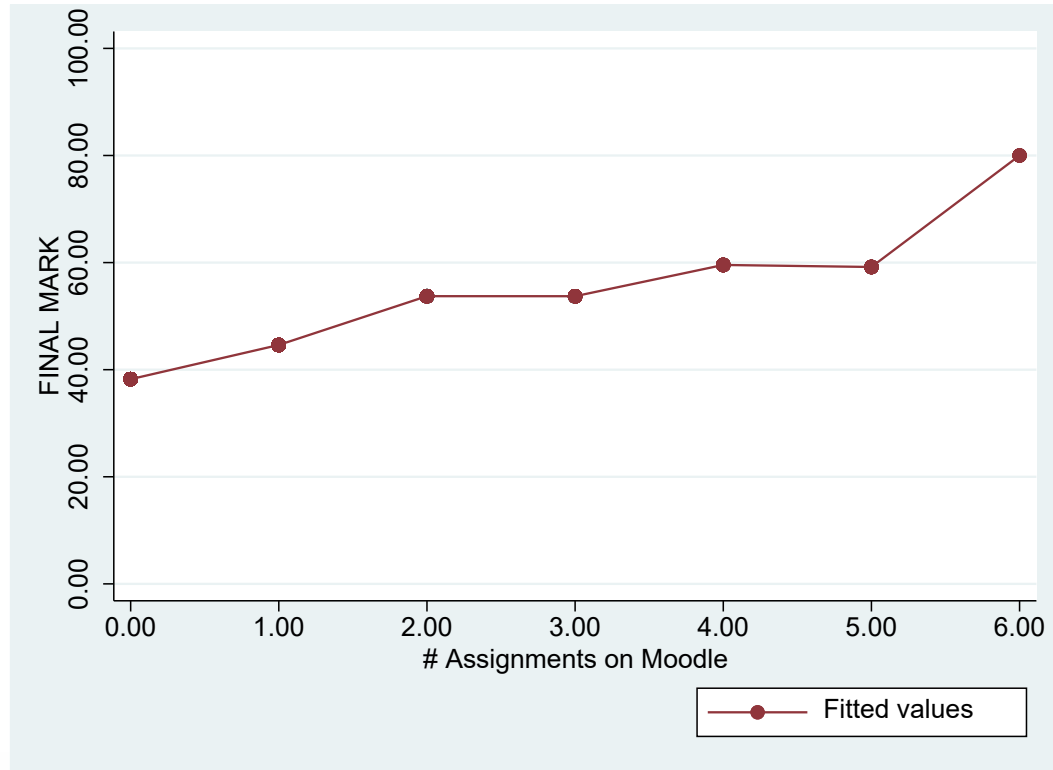
59.1%	Percentage of active Achieve users who were African, female & who passed
65.8%	Percentage of active Achieve users who were African, male & who passed
91.7%	Percentage of active Achieve users who were White, female & who passed
90.5%	Percentage of active Achieve users who were White, male & who passed
72.7%	Percentage of active Achieve users who were Coloured, female & who passed
63.6%	Percentage of active Achieve users who were Coloured, male & who passed
100%	Percentage of active Achieve users who were Indian, female & who passed
80%	Percentage of active Achieve users who were Indian, male & who passed
77.93%	**Average among Achieve users**
61.9%	**Overall average**

Consolidated pass rate based on those enrolled for the Intermediate Macroeconomics modules from 2016 to 2021

Source: HEMIS (2022)

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Analysis

More engagement ... better performance

Profiles by Race adjusted — Line chart of FINAL MARK versus # Assignments on Moodle, showing four race profiles (African, Indian, Coloured, White) all increasing with more assignments on Moodle.
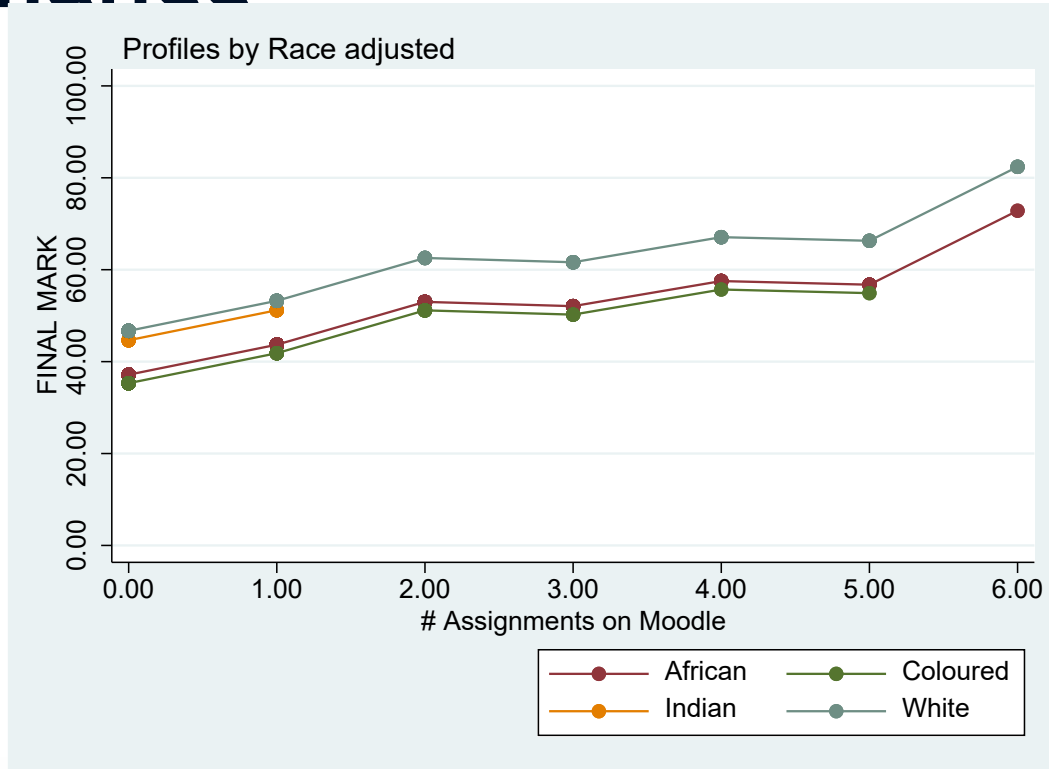
Performance by gender and pop. group

Profiles by Race adjusted. Graphs by Gender.
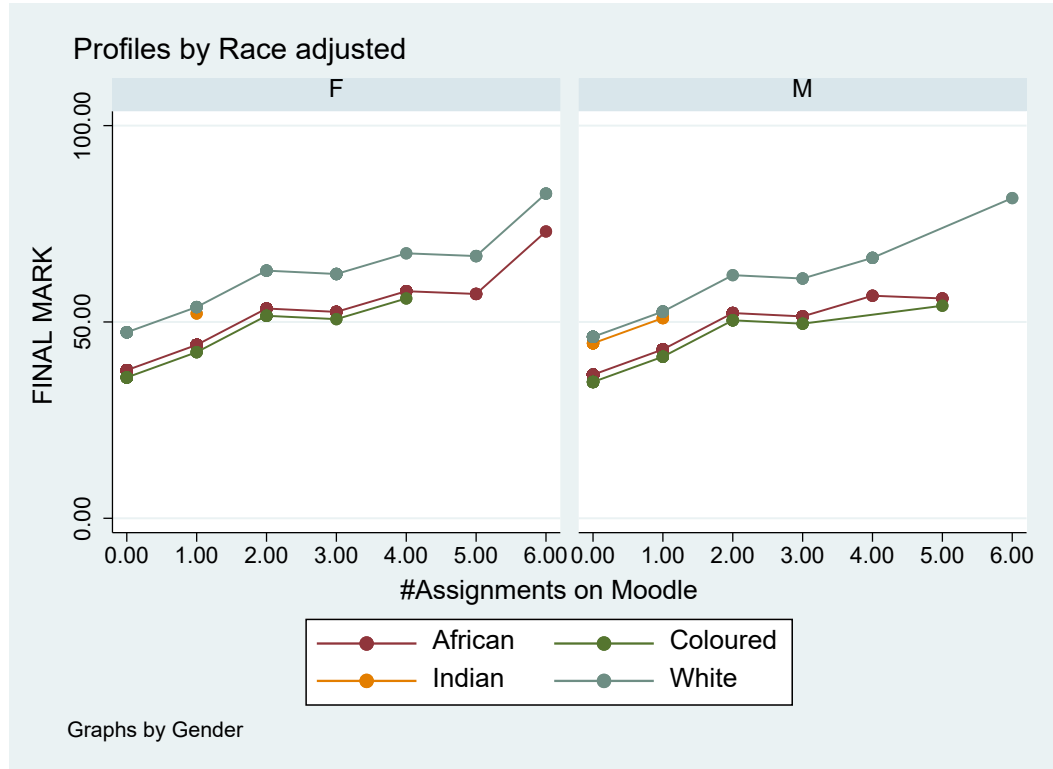
Regression results

FINALMARK	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Assignments on Moodle (Base 0)	0	.	.	.	.	.	
1	6.433	1.709	3.76	<0.00	3.075	9.792	***
2	15.709	2.57	6.11	<0.00	10.659	20.758	***
3	14.846	2.69	5.52	<0.00	9.562	20.131	***
4	20.117	3.992	5.04	<0.00	12.274	27.96	***
5	19.42	5.03	3.86	<0.00	9.538	29.302	***
6	35.335	8.335	4.24	<0.00	18.961	51.709	***
Race adjusted: (base African)	0	.	.	.	.	.	
Coloured	-1.851	2.627	-0.70	.481	-7.013	3.31	
Indian	8.002	5.537	1.45	.149	-2.875	18.879	
White	9.648	2.224	4.34	<0.00	5.278	14.018	***
Gender: Base F	0	.	.	.	.	.	
M	-1.151	1.448	-0.79	.427	-3.995	1.693	
Constant	37.717	1.301	28.99	<0.00	35.162	40.273	***

Mean dependent var	44.129	SD dependent var		18.087
R-squared	0.205	Number of obs		526
F-test	13.280	Prob > F		0.000
Akaike crit. (AIC)	4438.788	Bayesian crit. (BIC)		4485.706

*** p<.01, ** p<.05, * p<.1

Lessons learnt

- Generally, more quiz attempts, result in a higher final mark.

- Doing one Achieve assignment, on average, results in a student having a final mark **6.43% higher than one who did not attempt any assignment**.

- A student who **completed all 6 assignments has, on average, a final mark 35.34% higher than those who did not attempt any assignment**.

- Population group does matter, but only the White population group has a significantly higher mark (about 10% higher)

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Lessons learnt

- 2022: At first "concerns about the deep integration and the level of access it requires on the system."

  - This resulted in a delay in exposing the students to the *Achieve* platform, the use of a parallel system and may have contributed to the low uptake of the resources available on the *Achieve* platform.

  - Bit early start for 2023.

Lessons learnt

Clow's (2012) approach was followed in 2022.

This approach is based on the lecturer identifying which students fit into a risk category based on forecasts or prior course experiences (Van den Bogaard *et al*., 2016:5).

Norris, Baer, Leonard, Pugliese, Lefrere (2008:62), however, point out a shortcoming of such an approach, namely that the analytics are reactionary as previous student data is used to make decisions for future cohorts. Norris *et al*., (2008:62) thus advocate for using current student data to influence that cohort of students' learning

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2023: Tracking student participation

	Course Total	Assignments LC1: LearningCurve - Ch.1: The Science of Macroeconomics	Assignments PrQ1: Practice Quiz - Ch. 1: The Science of Macroeconomics	Ungraded Revision for Chapters 1 and 2	Ungraded Chapter 1 The Science of Macroeconomics	Ungraded Orientation Assignment
Points Possible		10	10	-	-	-
Resource Type		Adaptive Quiz | Graded	Assessment | Graded	Assessment | Ungraded	Reading | Ungraded	Assessment | Ungraded
Number of students that achieved above 50%	499/647= 77%	478	470			
% students that achieved above 50%	80%	77%	76%			
Average		77%	62%	250 students completed	524 students completed	369 students completed

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Ambassador – Comment

"I have highlighted in yellow the assessments that students did not complete, so that it is easier to identify those that have not been participating during the semester, in order to compare with their class marks and/or their final marks, in order to see the impact on their marks.
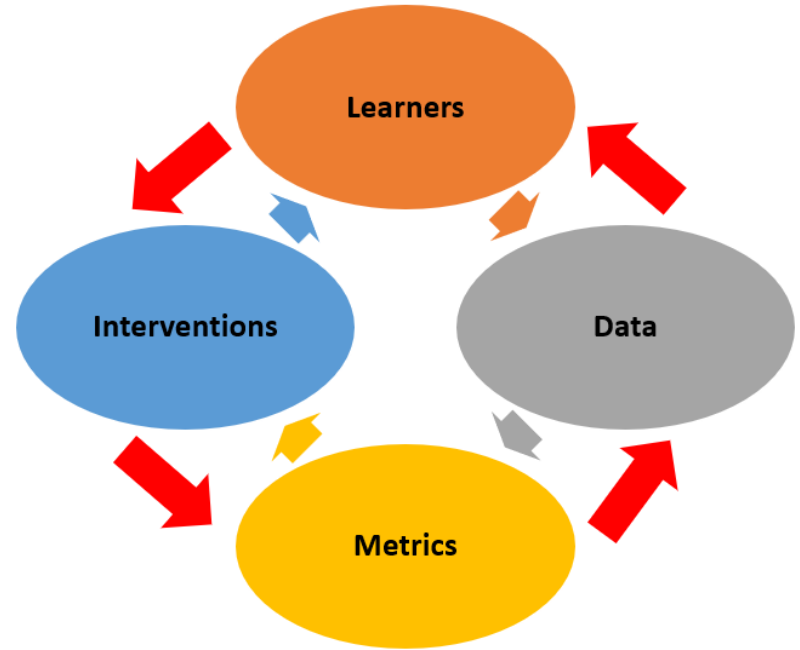
"Furthermore, this is just a suggestion, but I was thinking it might be useful, if possible, to check what their final mark was for ECC102, in order to assess how strong they were going into second year, as some top students may not need the additional resources. Whereas, if we had a student that did not attempt the majority of the Achieve assessments and failed and their final mark in first year was quite low, then we will know that it was probably as a result of them not participating and making use of all the resources that were made available to them."

Design

- Identify difficult concepts
  - Phased in access to Achieve [first group- treated; second group- control]
    - Randomise access [Achieve key allocation]
    - Socialisation/ social learning

Lessons learnt

- Should funding be secured for 2023, based on the criticisms raised by Norris *et al.* (2008) the researchers will attempt to test the possibility of feedback loops and how metrics and students can also directly feedback on each other, thus extending Clow's (2012) cycle to resemble the figure to the right:

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