Development and Implementation of a First Year Statistics Subject for Senior Secondary Indigenous Students to Encourage Future Engagement in Tertiary Studies

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Indigenous students are under-represented in the university sector, particularly science.

Problems:

- reduced completion rates at the secondary school level
- students who do continue to Year 12, often opt out of mathematics

A solution:

The Koorie Academy for Excellence (KAE) (established 2012)

- encourage and support indigenous students to complete their secondary education
- encourage and support students to pursue education at university

Community (KAE)

+

Indigenous Strategy Office

+

College/Faculty

+

Academics

Redevelop STA1DCT:

- ✓ culturally contextualized
- ✓ curriculum modularized
- ✓ retain academic rigor with same assessment of
- ✓ 5 assignments
- ✓ numeracy quizzes
- ✓ final examination

Engage Senior Secondary Indigenous Students

- ✓ Credit for university subject
- ✓ Numeracy is relevant (& fun)
- ✓ University is possible
- ✓ Support available

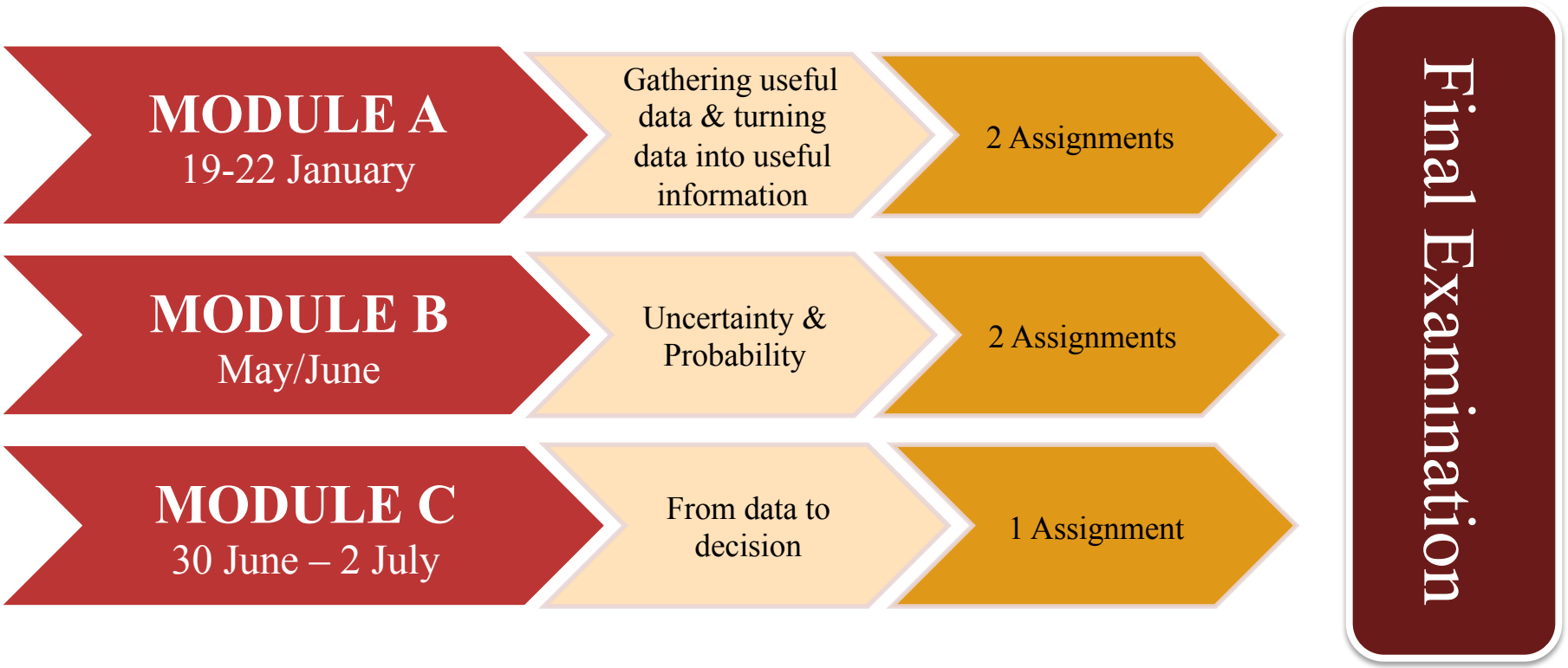
Links with the indigenous community

Trickle down effect to younger students

STA1DCT_IND Data Based Critical Thinking

The subject develops fundamental numeracy skills and critical thinking skills.

Participation in this program will help students see the relevance of numeracy skills in their lives and encourage students to consider a future in science and mathematics.



MODULE A
19-22 January
4 days

6 lectures
4 computer labs
numeracy quiz classes

MODULE B
May/June
3 days total

3 lectures
3 computer labs
numeracy quiz classes

MODULE C
30 June – 2 July
3 days

3 lectures
2 computer labs
exam revision

Module A:

Gathering useful data & turning data into useful information

Key Questions

1. Does evidence collected from data effect everyday life?

2. Is the sample representative of the population of interest?

3. How can we numerically and graphically explore the characteristics of variables?

4. How can we numerically and graphically explore the relationship between two variables?

Module A: Gathering useful data & turning data into useful information
Lectures

- Introduction to data
- Introduction to critical thinking
- Populations and samples
- Population parameters and estimates
- Representative samples
- Sampling bias and non-response bias
- Simple random sampling
- Understanding general formulae
- Measures of location:
  Average and median
- Proportions and percentages
- Measures of spread:
  Range, variance and standard deviation
- Graphical representations of data:
  Histograms, line plots, pie charts & column charts
- Thinking critically with numerical and graphical measures
- Exploring relationships between two variables
- Linear equations
- Scatterplots and the correlation coefficient
- Comparing two categorical variables
- Correlation does not imply causation
- Confounding variables

Module A:
Gathering useful data & turning data into useful information
Computer Labs

- Introduction to Excel
- `N choose n' calculations
- Proportions and percentages
- Sampling
- Location and spread estimates in Excel
- Using 'IF' statements in Excel to count occurrences
- Histograms and line plots in Excel
- Symmetric and skewed histograms
- Scatterplots in Excel
- Correlation and the importance of graphically assessing linearity

Module B:
Uncertainty & Probability
Key Questions

1. What is the relative frequency interpretation of probability?

2. What are the basic rules of probability?

Module B: Uncertainty & Probability

Lectures

- Observational studies & experiments
- Relative frequency interpretation of probability
- Equally likely outcomes
- Important probability definitions & results
- Events & complements of events
- Probability & independent events
- Dependent events & conditional probability

Computer Labs

- Equally likely outcomes
- Random number generation in Excel
- Probability simulations
- Estimating probabilities from simulations in Excel
- Relative frequency interpretation of probability & comparisons with estimated proportions
- Calculating conditional probabilities

Module C:

From data to decision

Key Questions

1. How can misconceptions of probability lead to flawed judgements?

2. What is the gambler's fallacy?

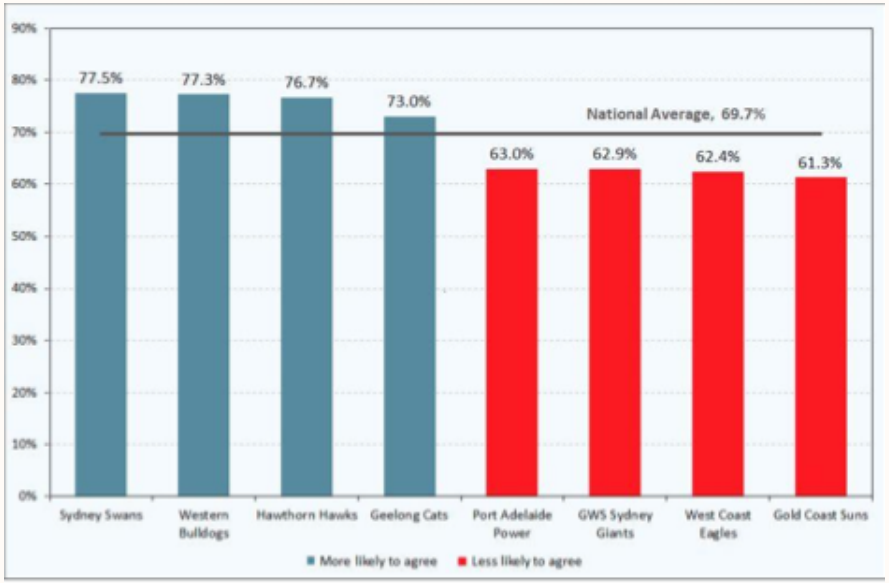
3. How can I use confidence intervals so that I, and others, can make informed decisions?

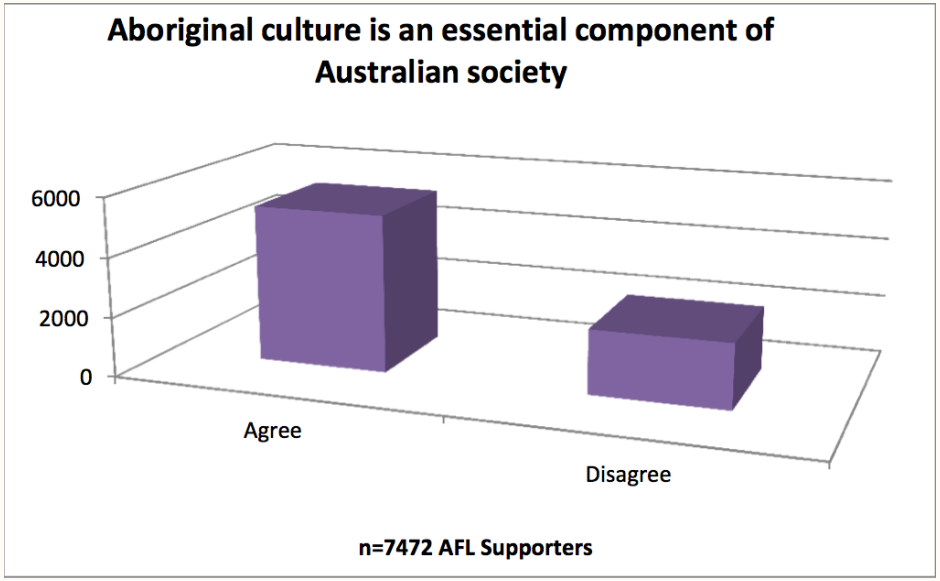
Module C: From data to decision

Lectures	Computer Labs
➢ Misconceptions of probability and flawed judgements ➢ Coincidences ➢ Simpson's Paradox ➢ The gambler's fallacy ➢ Confidence intervals ➢ Confidence intervals for proportions ➢ Confidence intervals for averages ➢ Revision	➢ Interactive computer test for ESP – coincidence or proof ➢ An example of Simpson's Paradox ➢ Simulating confidence intervals in Excel to understand 'confidence' ➢ Decisions from confidence intervals ➢ Revision

Customising some examples

- Ray Morgan poll of AFL supporters "Aboriginal culture is an essential component of Australian society." Discussion - histograms & column charts, proportions and percentages.





Roy Morgan research *Roy Morgan Single Source (Australia), January 2013-December 2013, n=7,472*

Customising some examples

- Statistics of 2014 Indigenous AFL players – means, medians, modes, proportions, correlation.

	AFL Indigenous Player	Games		AFL Indigenous Player	Games		AFL Indigenous Player	Games
1	Armstrong, Tony	5	20	Hill, Josh	9	39	Rioli, Cyril	12
2	Bennell, Harley	15	21	Hill, Stephen	20	40	Ryder, Patrick	21
3	Bennell, Jamie	19	22	Impey, Jarman	18	41	Simpson, Josh	1
4	Betts, Eddie	22	23	Jetta, Leroy	2	42	Stevens, Koby	20
5	Burgoyne, Shaun	25	24	Jetta, Lewis	25	43	Stokes, Mathew	20
6	Cameron, Charlie	7	25	Jetta, Neville	16	44	Sumner, Timmy	6
7	Christensen, Allen	8	26	Johnson, Michael	18	45	Thomas, Lindsay	23
8	Dempsey, Courtney	18	27	Jones, Liam	10	46	Varcoe, Travis	23
9	Edwards, Shane	23	28	Kennedy-Harris, Jay	14	47	Walker, Andrew	14
10	Ellis-Yolmen, Cameron	1	29	Lemmens, Sean	18	48	Walters, Michael	8
11	Franklin, Lance	22	30	Martin, Jack	11	49	Wanganeen, Derek	1
12	Garlett, Jeffrey	9	31	Matera, Brandon	16	50	Wellingham, Sharrod	13
13	Goodes, Adam	20	32	May, Steven	19	51	Wells, Daniel	10
14	Goodes, Brett	2	33	McGrath, Ashley	6	52	Williams, Zach	8
15	Griffin, Jonathon	1	34	Milera, Terry	5	53	Wilson, Nathan	6
16	Hampton, Curtly	11	35	Motlop, Steven	17	54	Wingard, Chad	24
17	Harbrow, Jarrod	22	36	Neade, Jake	8	55	Yarran, Chris	21
18	Hartman, Bradley	5	37	Pearce, Danyle	24			
19	Hill, Bradley	22	38	Petrenko, Jared	5			

Source: http://www.footywire.com/afl/footy/

Customising some examples

- AFL Statistics 2014

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Club	Kicks	Kicks	Handballs	Handballs	Disposals	Disposals	Marks	Marks	Hit-outs	Hit-outs	Frees For	Frees For	Frees Agst	Frees Agst	Tackles	Tackles	Goals	Goals
2		TOTAL	AVERAGE	TOTAL	AVERAGE	TOTAL	AVERAGE	TOTAL	AVERAGE	TOTAL	AVERAGE	TOTAL	AVERAGE	TOTAL	AVERAGE	TOTAL	AVERAGE	TOTAL	AVERAGE
3	Adelaide Cro	4562	207.4	3508	159.5	8070	366.8	1872	85.1	886	40.3	371	16.9	319	14.5	1366	62.1	315	14.3
4	Brisbane Lior	4164	189.3	3506	159.4	7670	348.6	1882	85.5	840	38.2	382	17.4	396	18	1405	63.9	221	10
5	Carlton	4620	210	2890	131.4	7510	341.4	2030	92.3	899	40.9	396	18	318	14.5	1353	61.5	276	12.5
6	Collingwood	4432	201.5	3272	148.7	7704	350.2	1872	85.1	778	35.4	325	14.8	356	16.2	1564	71.1	252	11.5
7	Essendon	5158	224.3	3684	160.2	8842	384.4	2470	107.4	843	36.7	361	15.7	367	16	1515	65.9	274	11.9
8	Fremantle	4968	207	3768	157	8736	364	2126	88.6	1284	53.5	356	14.8	419	17.5	1561	65	318	13.2
9	Geelong Cats	4904	204.3	3786	157.7	8690	362.1	2245	93.5	924	38.5	407	17	398	16.6	1676	69.8	315	13.1
10	Gold Coast S	4326	196.6	3247	147.6	7573	344.2	1609	73.1	723	32.9	343	15.6	386	17.5	1470	66.8	278	12.6
11	GWS Giants	4428	201.3	3414	155.2	7842	356.5	1920	87.3	944	42.9	363	16.5	401	18.2	1498	68.1	256	11.6
12	Hawthorn	5575	223	4334	173.4	9909	396.4	2332	93.3	1118	44.7	405	16.2	394	15.8	1558	62.3	418	16.7
13	Melbourne	4304	195.6	3421	155.5	7725	351.1	1945	88.4	986	44.8	388	17.6	379	17.2	1395	63.4	190	8.6
14	North Melbo	5217	208.7	4018	160.7	9235	369.4	2261	90.4	1047	41.9	433	17.3	428	17.1	1592	63.7	328	13.1
15	Port Adelaide	5232	209.3	4097	163.9	9329	373.2	2257	90.3	1058	42.3	423	16.9	429	17.2	1727	69.1	362	14.5
16	Richmond	4761	207	3746	162.9	8507	369.9	2000	87	923	40.1	437	19	430	18.7	1462	63.6	285	12.4
17	St Kilda	4334	197	3227	146.7	7561	343.7	2018	91.7	792	36	341	15.5	372	16.9	1422	64.6	212	9.6
18	Sydney Swar	5232	209.3	4218	168.7	9450	378	2060	82.4	927	37.1	422	16.9	411	16.4	1809	72.4	351	14
19	West Coast E	4538	206.3	3293	149.7	7831	356	1958	89	1077	49	382	17.4	335	15.2	1541	70	300	13.6
20	Western Bull	4222	191.9	3741	170	7963	362	1575	71.6	904	41.1	379	17.2	377	17.1	1548	70.4	257	11.7

Customising some examples

- IndigenousAFL players cultural groups and state of origin - proportions and percentages
- Eddie Betts' list of best AFL indigenous players in discussion of 'N choose n'

	AFL Indigenous Player	Cultural Group
1	Armstrong, Tony	Baranbinya
2	Bennell,Harley	Noongar
3	Bennell,Jamie	Noongar
4	Betts	Wangkathaa
5	Burgoyne	Warai/Kokatha
6	Cameron,Charlie	*
7	Christensen	Tiwi
8	Dempsey	Walluwarra/Kaantju
9	Edwards	Larrakia
10	Ellis-Yolmen	Kokatha
11	Franklin	Noongar/Wajuk
12	Garlett	Noongar
13	Goodes, Brett	Yudnamutana/Andyamathanha
14	Goodes, Adam	Andyamathanha
15	Griffin	Noongar
16	Hampton, Curtly	Warlpirri/Arrernte
17	Harbrow	Yidingdi
18	Hartman	Ngarrindjeri
19	Hill, Bradley	Noongar
20	Hill, Josh	Noongah/Bardi
21	Hill, Stephen	Noongar
22	Impey	Yorta Yorta
23	Jetta, Leroy	Noongar
24	Jetta, Lewis	Noongar
25	Jetta, Neville	Noongar
26	Johnson	Balardung
27	Jones	Kija
28	Kennedy-Harris	Palawa-Kani/Gugu Badhun/Yidinjdji
29	Lemmens	Turnakini
30	Martin	Yawuru
31	Matera	Noongar
32	May	Larrakia
33	McGrath, Ashley	Wongi
34	Milera	Koogatha
35	Motlop	Larrakia
36	Neade	Jingili
37	Pearce	Kokatha/Wirrangu
38	Petrenko, Jared	Andyamathanha
39	Rioli	Tiwi
40	Ryder	Noongar/Yamatji
41	Simpson, Josh	Yamatji/Wadjarri
42	Stevens	Gunai Kurnai
43	Stokes	Larrakia
44	Sumner	Ngarrindjeri
45	Thomas	Nawu
46	Varcoe	Narangga
47	Wanganeen	Wirangu/Narrunga
48	Walker	Yorta Yorta
49	Walters	Noongar
50	Wellingham	Nadja
51	Wells	Wangkathaa
52	Williams	Wiradjuri
53	Wilson	Noongar
54	Wingard	Kaurna
55	Yarran	Noongar

Source: http://www.aflplayers.com.au/indigenous-map/

Customising some examples

- Future referendum 2016/17-recognition of Indigenous Australians in the constitution* –quantitative vs categorical

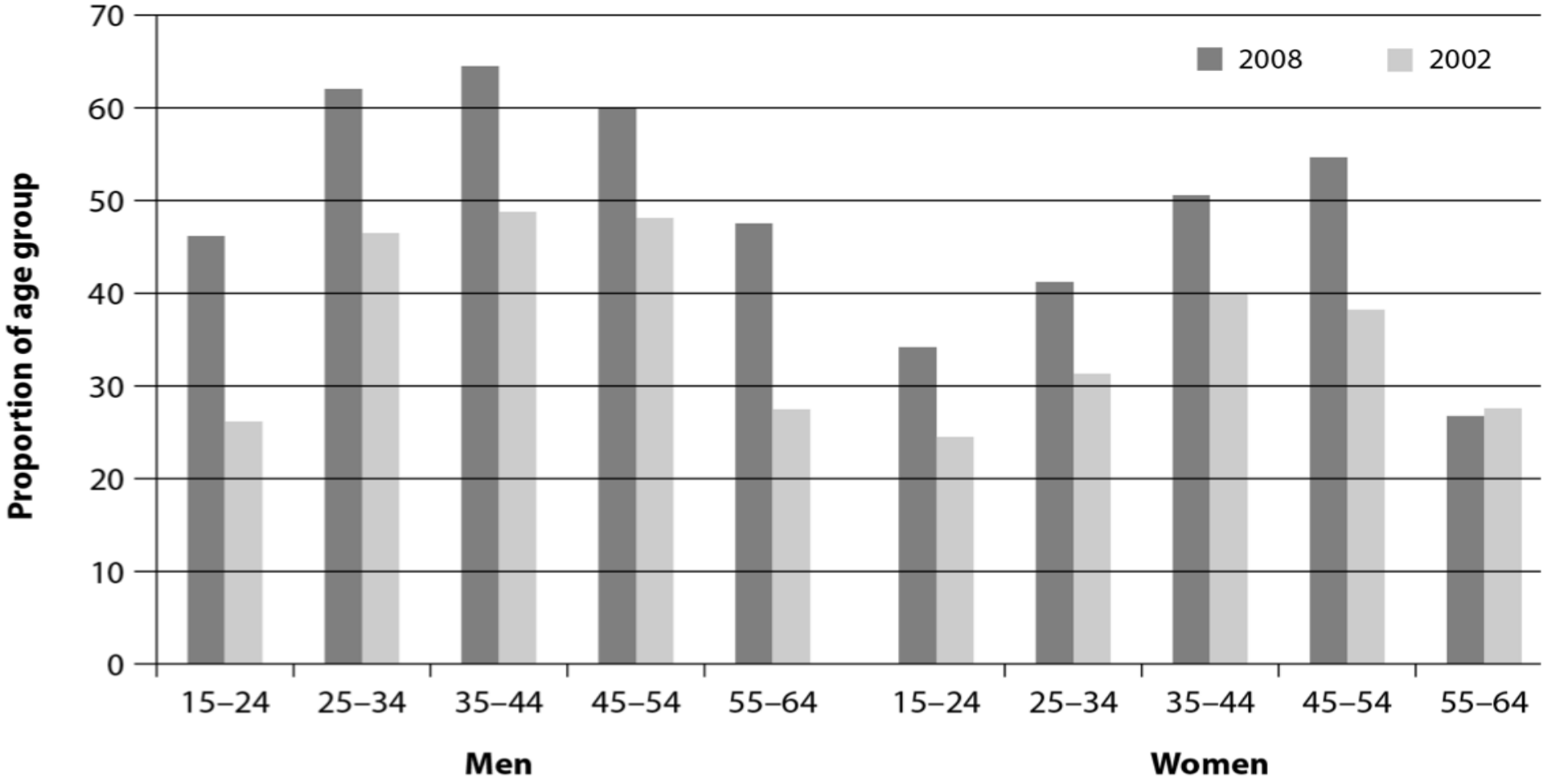
Age	Gender	Voting Preference	Change since last election?	Support recognition of Indigenous Australians in the consititution?
27	Male	Liberal	Yes	Yes
22	Male	Liberal	No	No
56	Female	Labour	No	Yes
36	Male	Undecided	NA	No
18	Female	Labour	NA	Yes
19	Female	Liberal	NA	Undecided
44	Male	Labour	No	Yes
78	Female	Greens	No	Undecided
22	Female	Other	Yes	Yes
40	Female	Liberal	No	Yes

Quantitative data
Categorical data

* Hypothetical data

Customising some examples

- NATSISS (National Aboriginal and Torres Strait Islander Social Survey) data – percentage increase and decrease



NATSISS Data: Proportion employed (excluding CDEP) by age group, Australia, 2002 and 2008

Source: Survey Analysis for Indigenous Policy in Australia, p.131

Customising some examples

- Used both
- NATSIHS (National Aboriginal and Torres Strait Islander Health Survey)
- NATSISS

to discuss

- quantitative vs categorical
- experimantal vs observational

Customising some examples

- Aboriginal children's games - in 2009, the Australian Sports Commission published *Yulunga Traditional Indigenous Games*, a book outlining a collection of indigenous games primarily the be used as a contribution towards implementation of indigenous Australian perspectives across the education curriculum

- Nanyima ('to play about") catch-ball game – probability of winning

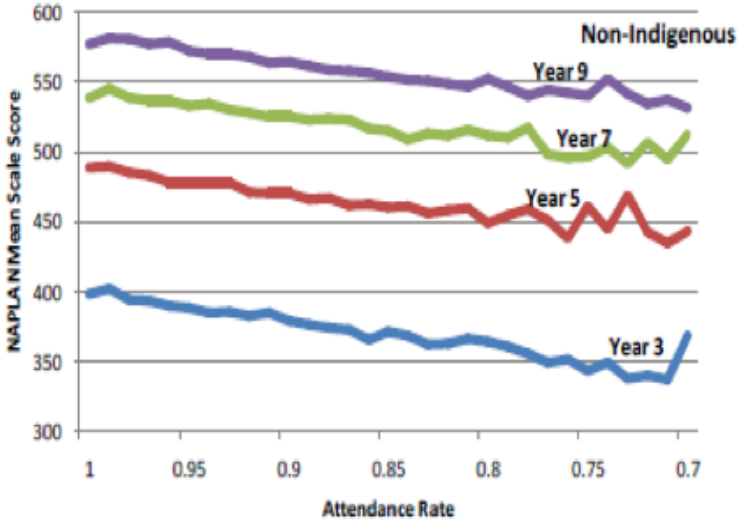
- Walbiri memory-testing game – probabilities of correctly guessing items

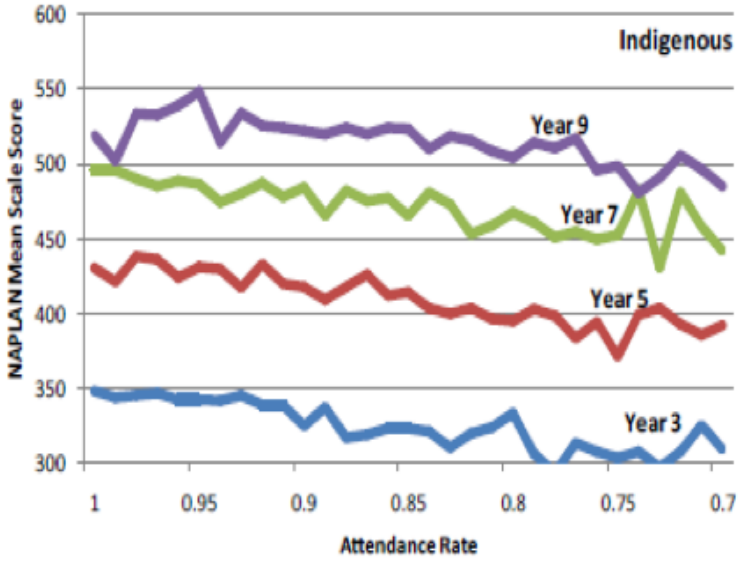
Customising some examples

- NAPLAN scores–indigenous and non-indigenous comparisons - attendance rate and reading score in Semester 1, Queensland, 2009

Source: Performance Insights: School Attendance, Department of Education, Training and Employment, October 2013

Figure 14: Indigenous and non-Indigenous Queensland state school attendance rate by NAPLAN Reading mean scale score[18]





Customising some examples

- It was offered to 6 students who were part of the Koorie Academy of Excellence.
- These students were all studying VCE/VET.
- 4 students commenced, but one withdrew due to personal reasons.
- All 3 students who sat the exam and completed the assessment were successful.
- All were year 11 students from a variety of secondary colleges in the Northern region.
- They were all learning Further Maths.
- The pilot may be expanded in 2016, depending on funding.
- Students will get credit for this subject at university.

Thank you

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