Great Expectations: I expect to pass because I already know all this stuff

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Maths support, who need's it!?

Our aim was to study the expectations and attitudes of poorly prepared mathematics students in first-year university.

- We know that students who utilise support services achieve significantly higher results.
- We know that many students arrive at university under-prepared mathematically.
- "It is noticeable also that the majority of the at-risk students did not [use support]." (Mac an Bhaird et al.)
- "most students are not using [support] because they believe they do not need help" (Mac an Bhaird et al.)
- How is it that we know they are under-prepared but they don't?

Attitudes and expectations: students' perspectives

Do staff perspectives align with those of students'?

- At the start of semester we see many poorly prepared students in our first year units;
- We have high failure rates;
- What are students' attitudes and expectations?
- How do students' perceptions change over a semester?
- Do students' expectations align with reality?

We conducted two surveys, one in the first week of semester and one at semester's end.

We have final grades for the three units surveyed.

Here we report mainly on the first survey.

Three first year mathematics units

Surveys conducted in three low level first-year first-semester units.

- Fundamentals of Mathematics: 60 students
  passing grades 56.7%, fail 33.3%, AF 10%
- Mathematics for Engineers Preliminary: 232 students
  passing grades 44.3%, fail 42.6%, AF 13.0%
- Quantitative Thinking: 229 students
  passing grades 76.9%, fail 17.5%, AF 5.7%

Many students are first-year first-semester students.

Many students have a poor maths background.

Three first year mathematics subjects

Students were surveyed on their

- mathematical background;
- attitude to mathematics;
- expected outcomes from the unit;
- expected grade for the unit;
- self assessment of skills in algebra, statistics, trig and calculus.

The survey took place in the first week of semester, which for most students is their first week at university.

Unit	Responses	Wk1 enrolment
Fundamentals of Mathematics	53	73
Mathematics for Engineers Preliminary	137	292
Quantitative Thinking	130	245
Total	320	610

(We learnt that about half the students did not attend their first lecture.)

Students' mathematics backgrounds

- Poor maths background overall: 61.6% have inadequate mathematics.
- No significant difference in background by unit.
- No significant difference in background by gender.
- There is a significant difference in background by age.

The background and age for the 300 students (232 were 20 or under, 68 over 20) for whom we had this information is shown. Twenty were omitted because of incomplete data.

Background	20 & under (%)	Over 20 (%)	Overall (%)
Advanced	9.5	14.7	10.7
Intermediate	28.4	25.0	27.7
Elementary	57.8	47.1	55.3
No maths	4.3	13.2	6.3

Barrington and Browns' classification of Australian final year secondary school subjects has been used.

Students' attitudes to mathematics

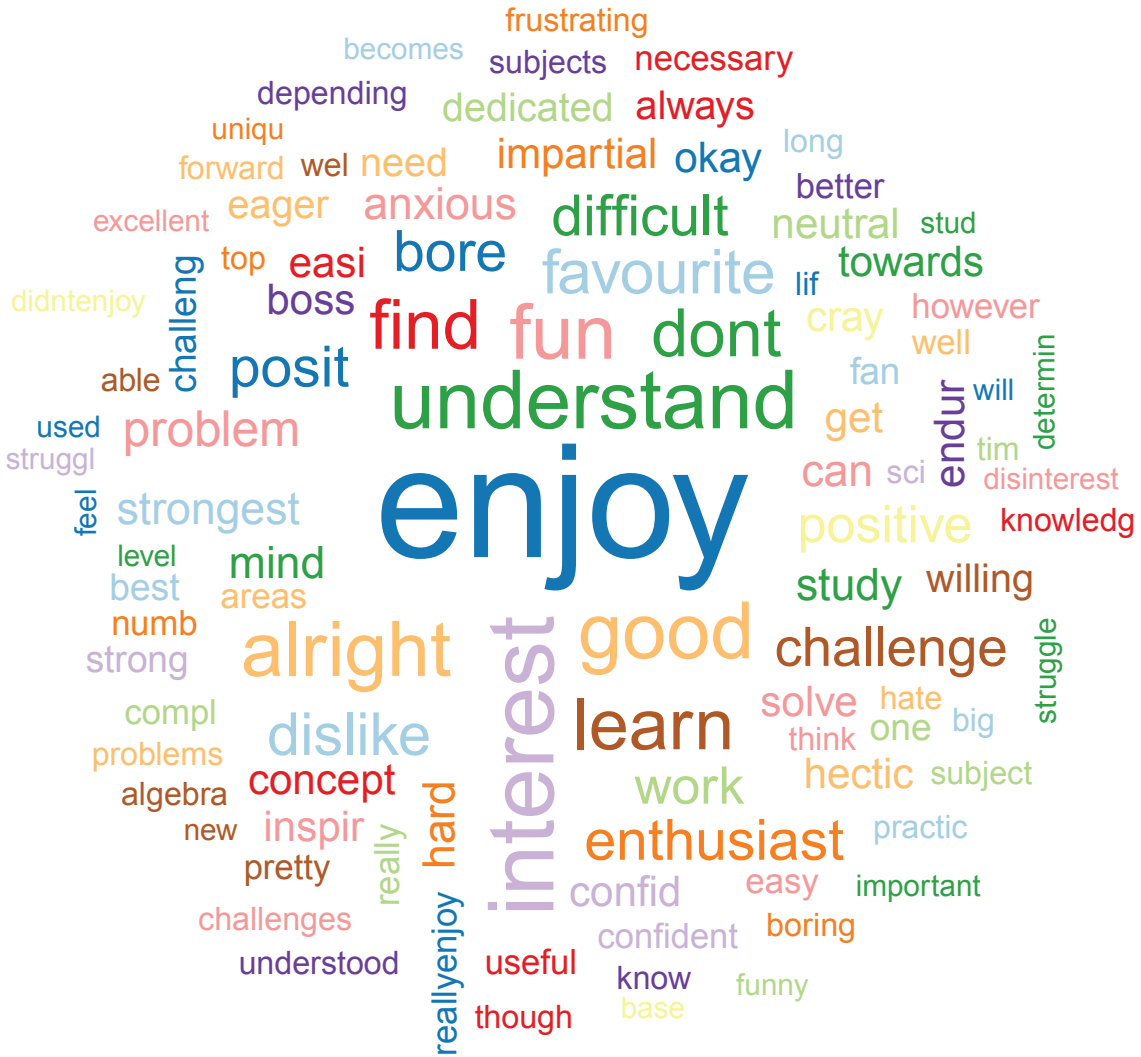
"It can be difficult but I enjoy how universal the maths language is"

"Highly confused and" anxious"

"A good challenge, I enjoy it"

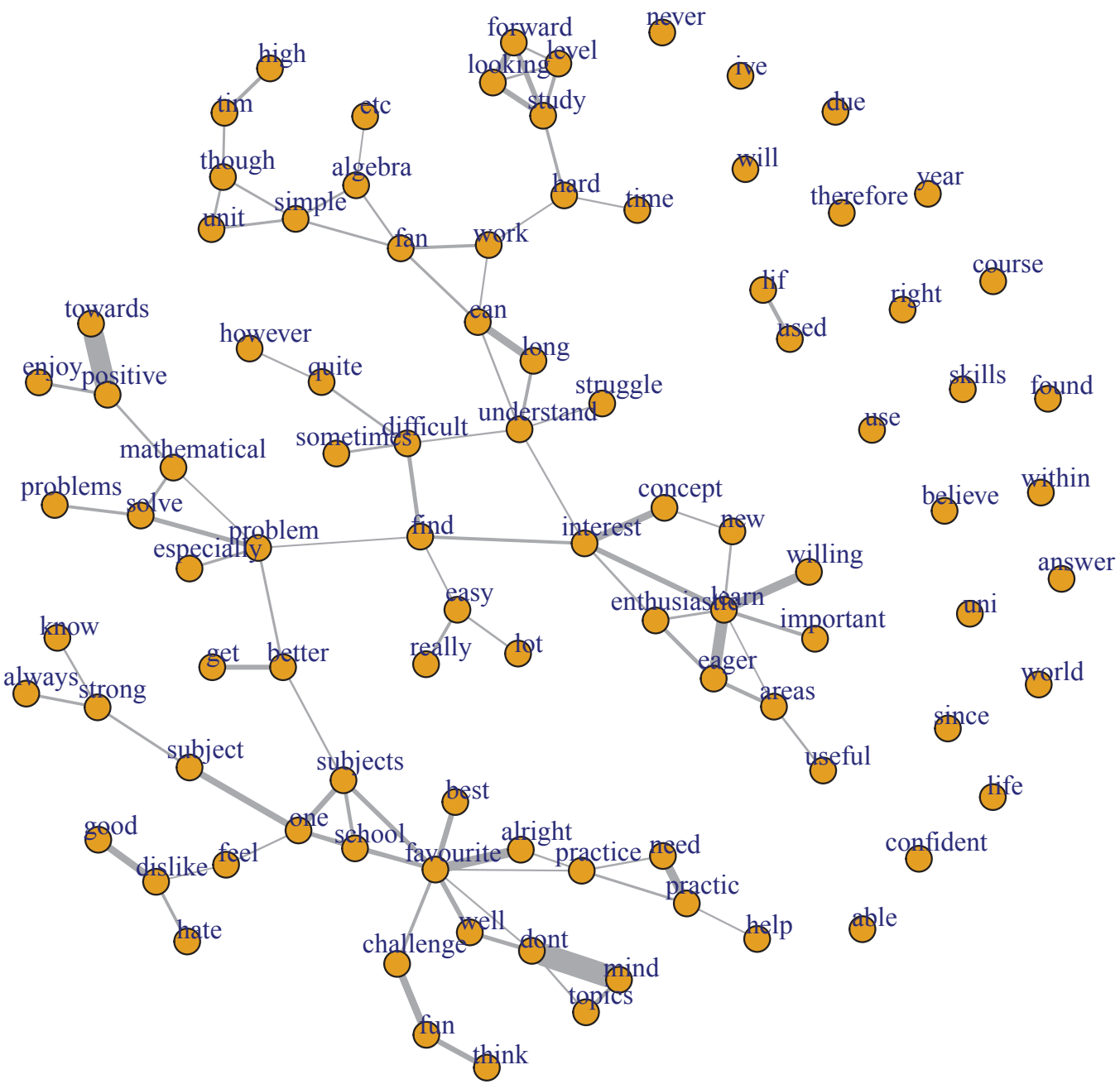
"Required and useful"

"Disinterested, but understand its value"



"Dislike it when I can't understand it; satisfying when I do"

Students' attitudes to mathematics



Students' expectations from their maths subject

"A better understanding of maths and its uses in engineering/science"

"Knowledge and understanding of maths"

"Problem solving skills"

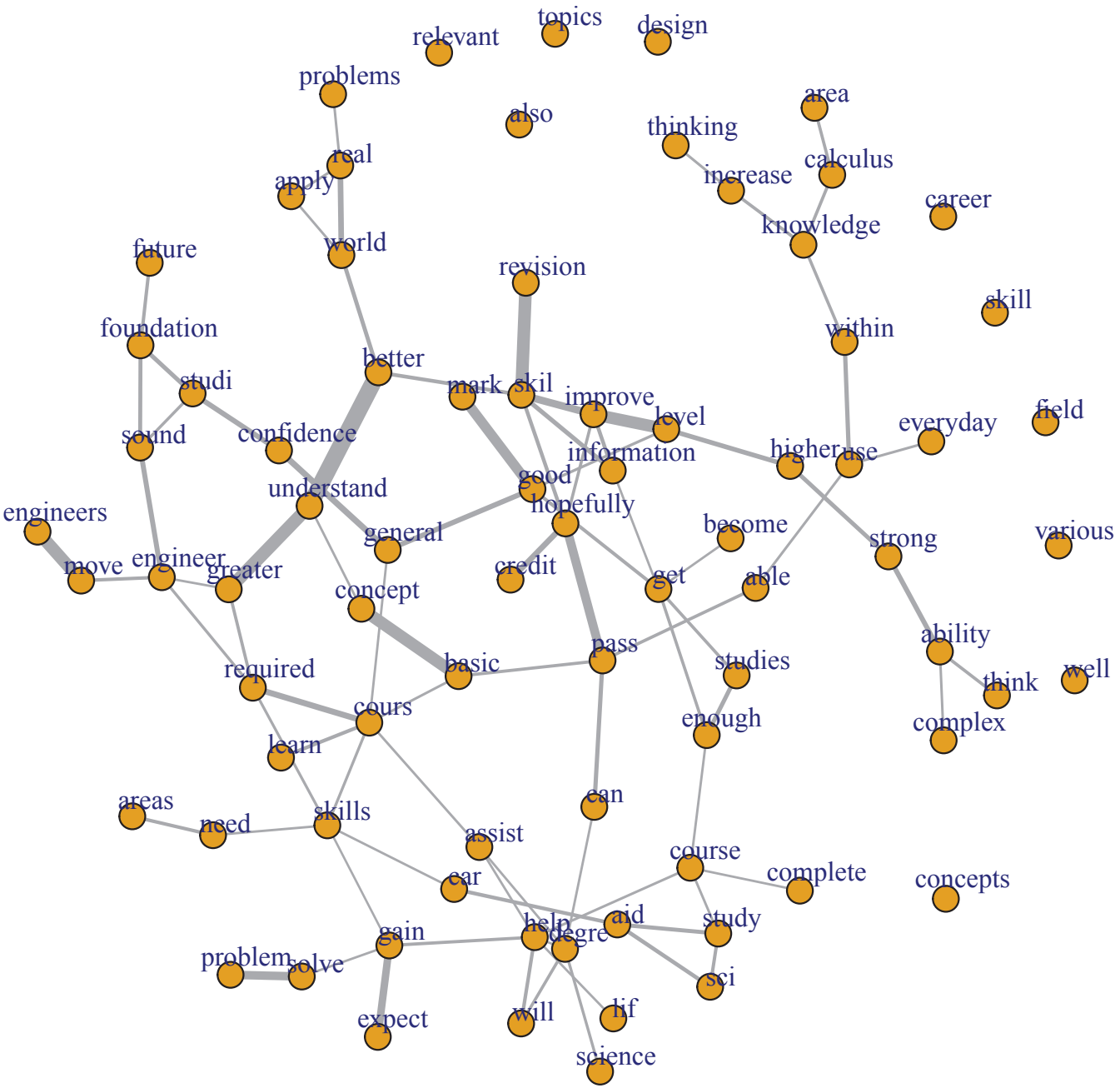
"A pass"

"Revision of basic maths"

"Gain mathematical skills that will help in life"

"It will help me in my future in various fields to get a good job"

Students' expectations from their maths subject



Students' expected grade by age

The table shows, for each age group, the percentage of students who expect each grade.

	20 & under (%)	Over 20 (%)
H (85% – 100%)	23	24
D (75% – 84%)	40	26
C (65% – 74%)	27	28
P (50% – 64%)	10	22
F (0% – 49%)	0	0

Note the percentages of expected D and P grades in the two groups. The younger students are more optimistic.

There is a significant difference between the two groups (chi-squared, $p < 0.05$)

H: high distinction, D: distinction, C: credit, P: pass, F: fail.

Students' self-assessment of algebra skills

Algebra skills self-assessment by high school maths background, given as percentages.

	None (%)	Elem (%)	Intermed (%)	Adv (%)
Good to excellent	0	29	36	58
OK	37	55	53	36
Weak	42	14	11	3
None to v. weak	21	1	0	3

The general trend is that the better the background, the higher students' assessments of their algebra skills.

Significant difference (chi-squared, $p \ll 0.0001$)

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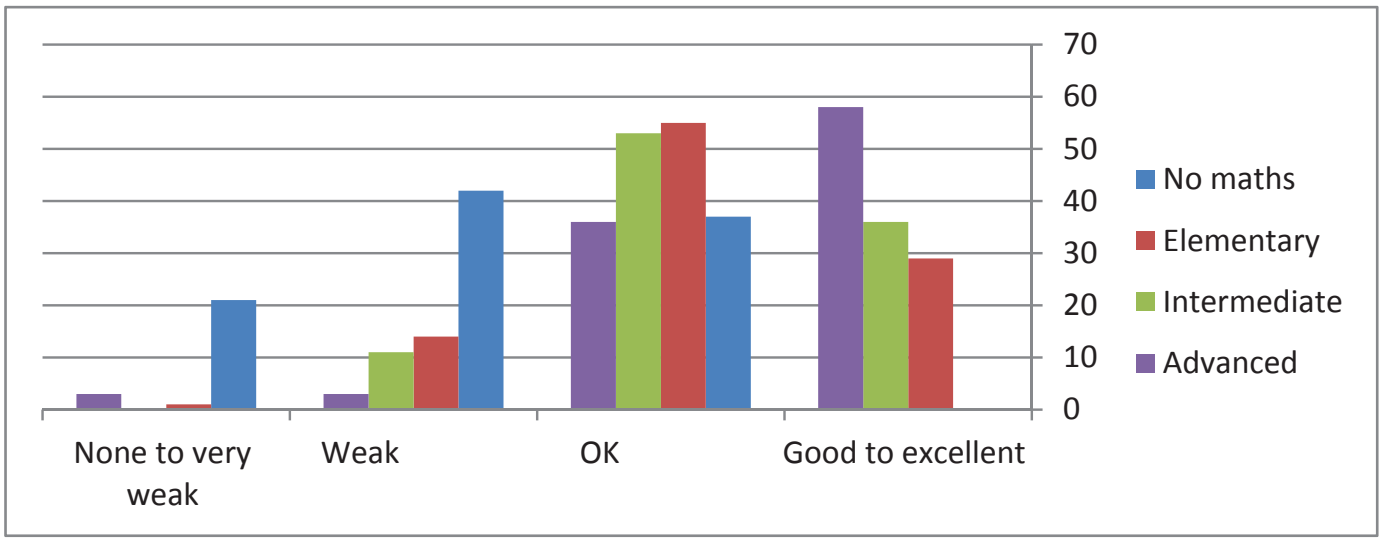

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Do they understand the questions?

There were 297 students whose background information told us whether or not they had done calculus previously. The table shows the answers to

My self-assessment of my current calculus skills is best described as

Self-assessment	With calculus (%)	No calculus (%)
Good to excellent.	31	3
OK.	43	26
Weak.	19	32
Non-existent to very weak.	7	39

61% (113 of 184) students who had not done calculus said that their calculus skills were better than "Non-existent to very weak"!

Students' expectations vs actual grade

Students' expectations were unrealistically optimistic.

- Of 265 students who stayed past census date, 79.2% expected a higher grade than they got, 12.5% got it right and 8.3% expected a lower grade.
- Regardless of high school maths background, roughly 80% expected a higher grade than they got.
- Students expected on average to get a grade 1.6 higher than they actually achieved.
- Female students expected to get 1.1 grades higher than actual.
- Male students expected to get 1.8 grades higher than actual.

Students' actual grade by age

The table shows, for each age group, the number of students who achieved each grade.

	H	D	C	P	F	AF	CF	E	X	Total
≤ 20	9	19	35	72	60	8	1	2	31	237
≥ 21	3	6	11	18	19	5	0	2	12	76
All	12	25	46	90	80	13	1	4	43	314

The older group had fewer Ps and more dropouts, as a percentage.
The total represents almost all students who attended the first lecture.
AFs were 4.1% of those at lectures in week 1 but 7.3% of all students, a statistically significant difference ($p < 0.001$)

Conclusions

- Students entering low level mathematics subjects are generally poorly prepared mathematically.
- Poorly prepared students don't see themselves as poorly prepared.
- Most students think that they will do much better than they will.
- Students expected grade increased with maths background, but were unrealistically high across all backgrounds. Same with self assessment of skills.
- That 50% of students expect H or D suggests they don't understand the system they've just entered.
- Self assessment in calculus suggests that students may not understand the technical language we expect of them.
- Students' attitude towards mathematics is very positive.

Questions

- Do students' high self assessment of skills mean that they believe that they will pass regardless?
- How can we correct this misapprehension before they become disillusioned?
- How can we maintain the positive maths attitudes?