



Transforming the “sage-on-the stage”: a student-centred approach to learning mathematics



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Outline

- Concerns with Math education
- How teaching was done originally
- Our concept
- How our concept was applied
- Student perception
- Tutor perception
- Performance indications
- Conclusions
- Future recommendations

The dreaded “maths”

- I was never good at maths but I have to be good at it because I have to be an Electrical Engineer):
- hi there, at school i was pretty average at math. The basics I was all right at and then everything else wrecks my head lol sad face!!
- I was not that good at maths when I was at school, but I could do simple things easily. Though, fractions make me crazy sometimes.
- My best ability at school cert level math would have been to able to add common numbers in my head without the add of a calculate. Everything else was difficult because I didn't apply myself to learning the basics
- According to the OECD report Programme for the International Assessment of Adult Competencies (PIAAC), 51% of New Zealanders are at below Level 2 for numeracy (can perform mathematical tasks with two or more steps where the mathematical content is explicit. These operations may include common decimals, percentages and fractions.



Original course model

- ▶ 2-hour sessions, three times per week
 - ▶ All course material was provided by printed booklets
 - ▶ Classes delivered by tutor face-to face in lecture/tutorial format
 - ▶ Some Excel-based assignments and written tests
- ▶ How to accommodate the wide range of preparation level apparent in the class?
- ▶ Need to encourage more active participation during scheduled class time and practice outside of class.

Our concept

- ▶ Encourage learners to attempt the work before the session
- ▶ Involve learners in the teaching
- ▶ Give learners the choice



Application of “shared leadership”



- ▶ Encourage learners to attempt the work before the session
 - ▶ Provide user friendly material
 - ▶ Include easy to understand videos
 - ▶ Access to resources
 - ▶ Review quizzes with immediate feedback

Application of “shared leadership”



- ▶ Involve learners in the teaching
 - ▶ In groups – to peer teach
 - ▶ Students to quiz the class
 - ▶ Students to lead the class

Application of “shared leadership”



- ▶ Give learners the choice
 - ▶ On how, where the learning takes place
 - ▶ On when they want to be assessed
 - ▶ On how much they want to be assessed on



Learners perception

- ▶ Need to spend extra time before the session preparing for the session
- ▶ Having the material as short videos is helpful
- ▶ Review quizzes (with instant feedback) help check the learning
- ▶ Makes the class an informal space and are comfortable
- ▶ Students take ownership to teach
- ▶ Stronger students encourage the weaker students
- ▶ Love the challenge of coming up with “interesting” questions for the class

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Staff perception

- ▶ Making the course self-paced allows more time to be spent with those students needing extra help
- ▶ Even the weaker students can experience success. Success brings confidence and help overcome math-phobia.
- ▶ Weaker students still need more support and encouragement to engage with the online material
- ▶ The online marking system has a few frustrating characteristics which led some students to mistrust it.



Learners Feedback

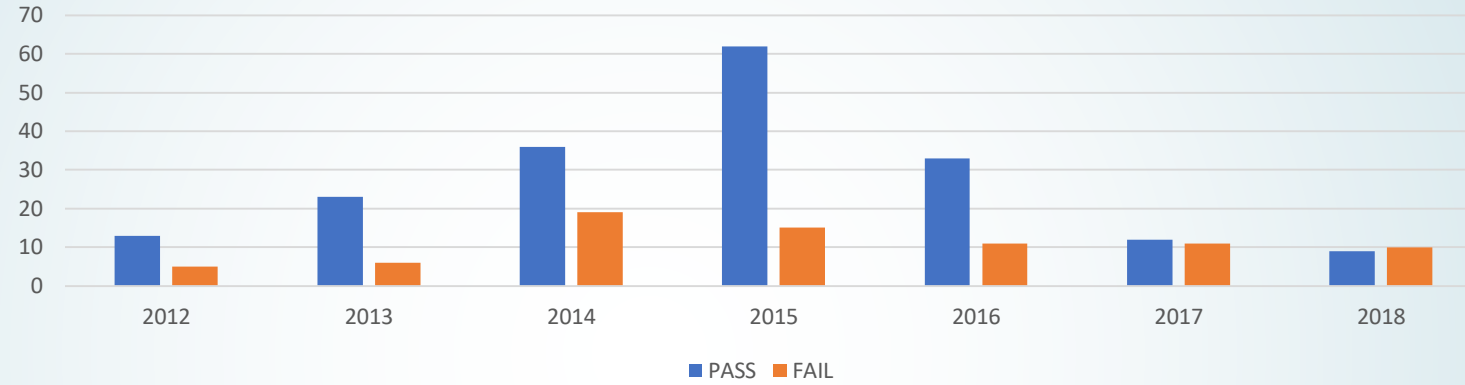
- ▶ Like the self-paced nature of the course
- ▶ Small tests on each topic are better than three big tests. Less pressure and material to recall all at once.
- ▶ Can study outside usual hours and refresh material if needed.
- ▶ Once I got used to the *MyMathLab* Global system, it was good to use and gave me lots of practice and feedback.
- ▶ Liked having two attempts at each test; so could bomb out or muck up the first and improve on the second.

Analysis of performance

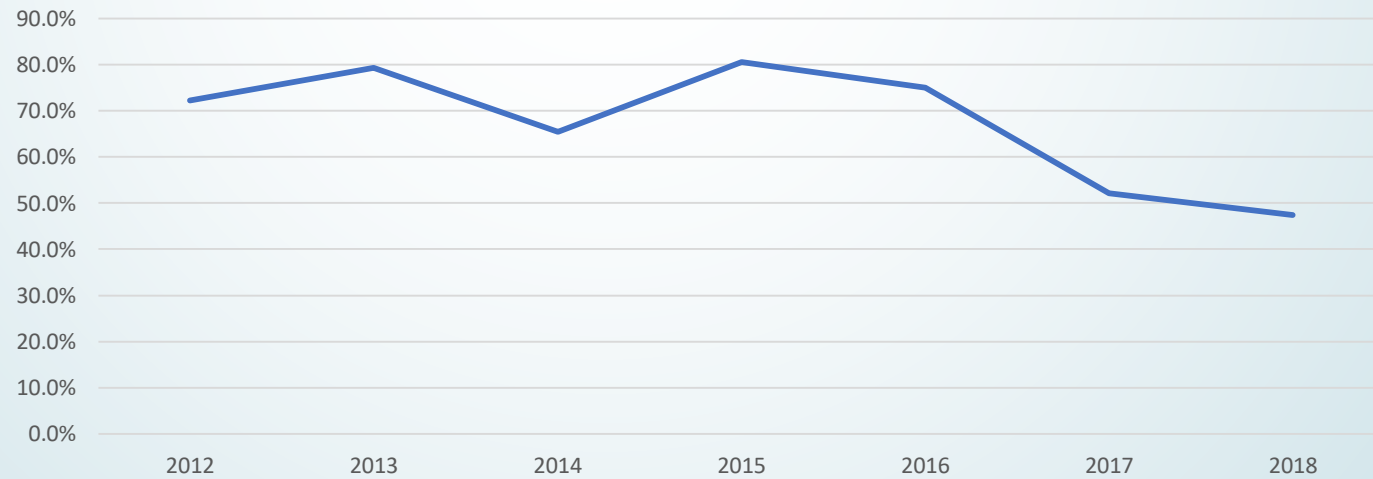
- ▶ Students hard at work on their online assignments.
- ▶ Since swapping to the self-paced non-traditional approach the pass rate has improved to about 70% each semester from about 55%
- ▶ There is still a small core of students for whom this approach does not lead to any significant improvement

The course changes were implemented in 2015

Numbers of students passing and failing the course



Pass Rates over the past 7 years (course re-design in 2015)



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Conclusion

- ▶ Although class satisfaction as measured by student feedback (e.g. Moodle SETMAPs) has improved, overall pass rates have not (exaggerated by declining class numbers).
- ▶ The self-paced approach with student-centred learning leads to a better mindset towards mathematics and may help overcome maths-phobia in some students
- ▶ Moving away from traditional “sage on the stage” teaching allows for a more comfortable class atmosphere and allows the tutor to focus on the at-risk students.

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Further recommendations

- ▶ Investigate online learning systems which have individualised feedback according to student's response at each step.
- ▶ Track students who go on to further mathematics courses to see if their improved confidence results in ongoing success.



Related research

- ▶ *Ashcraft, M.H. (2002), "Math anxiety: Personal, educational, and cognitive consequences", Current Directions in Psychological Science, 11 (5): 181–185.*
- ▶ *Hembree, R. (1990), "The nature, effects, and relief of mathematics anxiety", Journal for Research in Mathematics Education, 21 (1): 33–46.*
- ▶ *Skills in New Zealand and around the world: Survey of Adult Skills, Ministry of Education and Ministry of Business Innovation and Employment. June 2016, OECD Programme for the International Assessment of Adult Competencies*



Thank you

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