Digital Uplift of Statistics Courses: What? Why? How?

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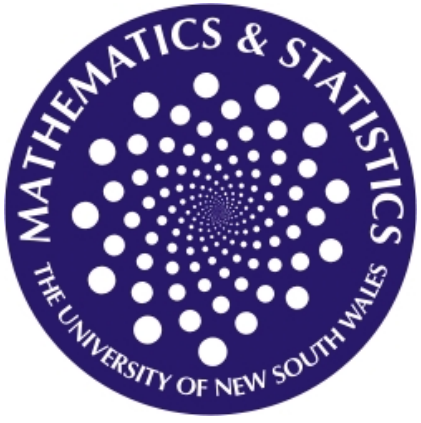


Video Recording: https://youtu.be/LUCYW7Hb_3g

Other People Involved

- Diana Combe and Jonathan Kress.
- Dhanushi Abeygunawardena, Amanda Yeung and Vanessa Huron (Office of the Pro-Vice Chancellor (Education)).
- Clement Chiu and Vienna Lu (Co-op students; conversion of slides from LaTeX to RMarkdown).
- Zach Aandahl (`RShiny` developer), Derek (video technician) and Alexander Goryun (animation developer).
- Peter Straka (GitHub).

Disclaimer

- We only slightly changed the course material for MATH1041 (appearance and reorganisation for 3+). In fact these notes are nicely written and easy to teach with (thank you to all our predecessors!).
- This project was **not** intended to make MATH1041 fully on-line[1].
- We don't know if our Digital Uplift enhancement will make things better or easier. It will go live in Term 1, 2019.

[1] This is different from MATH2018-Engineering Maths which also underwent a Digital Uplift (led by Shane Keating) in 2017 but was fully online.

What is a Digital Uplift?

digital = *composed of data in the form of (especially) binary digits*.
uplift = *a bettering of a condition especially spiritually, socially, or intellectually*. (Source: Merriam-Webster dictionary)

Initiated in 2017, the UNSW Digital Uplift Program's mission is to redesign 660 university blended and fully online courses by 2021 in partnership with staff and students (100 in Science). (source)

Digital Uplift consists in: (source)

- Leveraging available technologies to improve student experience and learning outcomes through a more personalised, flexible and digital learning experience with support for active and student-led learning spaces
- Informed by good pedagogy and learning design
- Can support face-to-face, blended, or fully online delivery
- Opportunity to utilise PVCE resources

The RASE model

The RASE model is used to design courses for effective, student-centred learning, through:

- **R**esources, but content alone is not sufficient for full achievement of learning outcomes;
- **A**ctivities for students to engage with the resources;
- **S**upport to ensure that students are provided help and tools to independently solve emerging difficulties;
- **E**valuation to inform students of their progress and help them understand what else is needed to achieve the learning outcomes.

Common Challenges Highlighted by the PVCE

✓ = we had (partially) or we now have

- Teach or review pre-requisite knowledge
- Prepare students for lectures & workshops
- Support students to conceptualise ideas
- Move materials online to make more effective use of lecture time (flipped classroom)
- Make face-to-face lectures more interactive ✓
- Create resources & activities to consolidate lecture materials ✓
- Provide demonstrations and worked examples ✓
- Create opportunities to engage in higher level thinking (e.g., design, problem-solving, application of theory to practice) ✓
- Develop or improve online assessments ✓

Common Challenges Highlighted by the PVCE cont...

- Improve quality and timeliness of feedback
- Provide opportunities for self-evaluation
- Create more opportunities for collaboration and teamwork
- Improve student engagement ✓
- Develop or curate support resources ✓
- Improve structure and aesthetics of course site ✓
- Integrate learning analytics
- Provide more support to international students
- Make course more accessible & inclusive
- Designing content in modules for maneuverability for reorganisation ✓
- Ability for the content created to be used across multiple courses

Showcase

A few examples of what others at UNSW have done.

Inspired Learning Initiative (ILI): Blended Learning Showcase
Moodle site: https://moodle.telt.unsw.edu.au/course/view.php?id=30191
Student Enrolment Key:
ILIshowcase17

The Inspired Learning Summit (ILS) is an annual event that celebrates educational innovations and partnerships enriching education at UNSW.
https://ils.teaching.unsw.edu.au/

Key Benefits of Teaching Online

- Increased flexibility of time: Learning and teaching can occur at times that are more convenient and productive for both students and teachers.
- Increased flexibility of location: Learning and teaching can take place in any location (home, office, while commuting, coffee shop) and can include students and teachers from diverse geographical locations.
- Context: Online education gives learning a new relevance to contemporary society and professional and industry practice.
- Information sharing: Online education provides opportunities to access and share information more easily and readily.

Key Benefits of Teaching Online cont ...

- Online resources: Online education provides access to a greater depth and breadth of resources and information.
- Access, equity & disability: Online delivery provides a mechanism for equal opportunity amongst students and teachers living with a disability, or who have accessibility difficulties that restrict their ability to attend a face-to-face class.
- Digital information literacy: Online learning develops digital literacy skills that are increasingly required in contemporary society and workplace environments.
- Administration: Online education can streamline some administrative aspects of teaching.

MATH1041: Statistics for Life & Social Sciences

- MATH1041 is our largest first-year statistics course servicing around 600 students per semester.
- It is an introductory statistics course intended for a large cohort of students from various disciplines.
- In January 2018, MATH1041 was chosen as one of three maths courses to undergo a Digital Uplift of the course.
- Since we were the course conveners for MATH1041, Pierre and I had to be involved in this development.

Why a Digital Uplift for MATH1041?

A **scholarly** approach to teaching: as in research, identify potential problems, try existing or invent new strategies, measure their effectiveness, improve.

What are our current problems? What do we want to achieve?

- Number of students attending lectures is low ($\sim 15\%$).
- They are not engaging very well.
- They seem to not like statistics very much.
- Results for the final exam are quite good. However, exams are relatively easy, very similar from one year to the other, and past exams are available (called practice exams, provided with their solution). What are we really measuring here?

Why a Digital Uplift for MATH1041? cont. . .

What are our current problems? What do we want to achieve?

- What is the future of statistics/data science? (New software, Big Data, etc.)
- What is (should be) our added value as teachers compared with non-math teachers of statistics courses?
- Due to disruption arising in higher education, we should build courses that are distinctive. Students should gain something valuable from our courses, otherwise they will go and learn elsewhere (e.g., YouTube or Khan Academy), for a (much) lower price.
- Is our students' learning better compared with other universities?

Why a Digital Uplift for MATH1041? cont ...

What are our current problems? What do we want to achieve?

- Can we propose different paths of (personalised) learning depending on how a student masters one topic?
- Can we check if students' results improve over time (collect evidence of learning)?
- Always the same mistakes. Indicate to students common mistakes made by the others (same or previous years).
- We are statisticians. Can we use machine learning algorithms to build personalized paths of learning (with data collected during the trimesters)?

Why a Digital Uplift for MATH1041? cont . . .

We still wanted face-to-face student interaction, so we kept class lectures and tutorials. We also kept the online labs as they are.

So what exactly did we "Digitally Uplift" for MATH1041?

The MATHxxxx R-package: New Lecture Slides

Aim: To enhance context, online resources, interaction and digital information literacy.

- We developed new lecture slides incorporated in RMarkdown through an R package called MATHxxxx (developed by Pierre).
- Slides are written directly fromRStudio (https://www.myaccess.unsw.edu.au/applications/r-studio). R codes are incorporated within the lecture notes and output obtained on the fly.
- Very easy (purl()) to extract all R codes from slides and give them to students. We no longer have to cut and paste R output to slides.
- All figures are now directly compiled in the lecture notes. Full reproducibility.

Other Features

- nice looking output (e.g., MATH1041 students are not really used to the chalk in their other courses!)
- nice icons/colors to facilitate students' understanding
- easy (i.e., automatic) to incorporate R code (or Python, SAS, etc.) with "syntax highlighting"
- lecture slides easy to create/maintain (Markdown)
- lecture slides easy to distribute to colleagues (Github: `https://github.com/UNSW-MATH`)
- uniformity over the various (stats) courses
- export to PDF (for printing), HTML (for interactivity), etc.
- quizzes, videos, interactive applets, 3d, timing clues, etc.
- UNSW branding (`https://www.brand.unsw.edu.au/`)

Summative Peer Review of Teaching

Going for Promotion? You need to be evaluated on 6/9 Dimensions of Teaching (https://teaching.unsw.edu.au/summative-peer-review).

Use `MATHxxxx`: embed clues in slides to easily address some dimensions.

1. Students are actively engaged in learning ✓ (groupwork)
2. Students prior knowledge and experience is built upon
3. Teaching caters for student diversity
4. Students are encouraged to develop/expand their conceptual understanding
5. Students are aware of key learning outcomes ✓ (what did we ...)
6. Actively links theory and practice through research, industry, professional or discipline examples
7. Uses learning environments, education resources and techniques appropriately
8. Seeks feedback on students understanding and acts on this accordingly ✓ (quizzes)

RShiny Apps

Aim: To enhance context, online resources digital and information literacy.

- We developed 8 web applets (`RShiny` apps) to play/interact with various parameters in order to understand better a few statistical concepts:
  `https://math1041.qa.teaching.unsw.edu.au`

Moodle Page

Aim: To enhance organization and administration.

- We redesigned the Moodle page (work in progress): https://moodle.telt.unsw.edu.au/course/view.php?id=36201

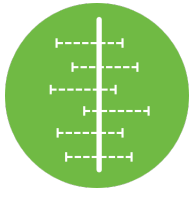
Concept Map

Aim: To enhance organization and administration.

- We developed a concept map which takes the form of building blocks through Prezi : https://moodle.telt.unsw.edu.au/mod/page/view.php?id=1867723

- A logo for each one of the 10 chapters was created so that students could easily see how various parts of the course are connected. These also appear in the new lecture notes.

Week 2: Regression



Week 6: Confidence Intervals

Case Study Videos

Aim: To enhance context, resources and information sharing.

- We developed four case study videos by interviewing four speakers : https://moodle.telt.unsw.edu.au/mod/page/view.php?id=1868911

- We can use these for examples in lectures and for assignments.
- We also did a welcome video.

Animation Video

Aim: To enhance context, resources and information sharing.

- We developed an animation video to explain what a continuous random variable and its density curve are :
  https://www.youtube.com/watch?v=2dXJDOTRs1Q

Other Additions

- Polls (via "polleverywhere" which is LaTeX compliant) to collect data and run class surveys. https://www.polleverywhere.com/

- Implemented new quizzes and some interactive materials for lectures (for example, students are asked to work in groups in lectures).
- GitHub repository (for the lecture slides).
- Pedagogy/style? see McKeachie (2013).

Thoughts and Summary

- If you are involved in digitally uplifting a course, then aim to reduce your teaching load or seek teaching relief!

MATH1041 Statistics for life and social sciences

Course Totals	
Estimated time to complete Core RASE and Block Items:	44:20
Estimated time to complete supplementary RASE and Block items:	0:02
Estimated Academic Effort:	280:00
Estimated Educational Developer Effort':	437:00
Estimated Freelancer Effort:	AUD $19,513

- Use `DataCamp` (`https://www.datacamp.com/`) to perhaps replace Maple TA. This is aimed towards (partial) automatic marking and a more natural integration with `RStudio`. Demo

- Award virtual medals (badges) for achievements on Moodle.
- Film more case study videos!

Open Floor Discussion

- How can we increase lecture attendance?
- Should we increase lecture attendance?
- Is online teaching a good thing?

Bibliography

McKeachie WJ (2013). *McKeachie's Teaching Tips*. Cengage Learning.