

Taking the “aaagghh!” out of research: Inspiring high quality research and improved clinical practice through accessible, authentic, supported learning

OVERVIEW: CONTEXT AND SUMMARY OF CONTRIBUTION

Robust research in health, by health professionals, is not only crucial to improve individual health, but also impacts substantially on population health and longevity, which in turn impacts productivity, and ultimately the economy.¹ For health professionals to deliver high-quality health care, it is therefore critical they be informed by evidence. However, an underlying fear/hatred of the “s word” (statistics) is a barrier to deeply engaging with research. This in turn compromises the quality of research conducted and the capacity to critically engage with research to inform practice.

I am an Epidemiologist with expertise in Research Methods (RM) and evidence-based practice, and a passion for facilitating excellence in health research with applied, translatable outcomes. I aim to provide students who are typically fearful and avoidant of RMs (defined here as tools/processes used to collect data for analysis to create new information and knowledge) the opportunity to become familiar with their basic application and build confidence in using them, whether in applied research or in critically interpreting others’ research. I am genuinely focused on improving my students’ understanding and application of the material to facilitate deep learning, and thus inspiring and equipping them with the skills they need throughout their studies, in their workplaces, and in their professional careers to face the [health] challenges experienced by people in the tropics. This aligns directly with the strategic intent of James Cook University (JCU), “to create a brighter future for life in the tropics worldwide through graduates and discoveries that make a difference”.

As a first-in-family undergraduate then PhD student, I was necessarily pragmatic in my learning approach, which now translates to my teaching. While learning how to engage with and conduct research myself, I gained a solid grounding in evidence-based practice (EBP) through fortuitous casual employment with leaders in EBP who have profoundly influenced the direction of health education and health professions internationally. This is the lens through which I see, learn and teach, and means that I know first-hand the gap that exists between clinicians and research. Accordingly, my focus since starting at JCU in 2011 has been on developing, evaluating and translating evidence, and applying innovative Learning and Teaching (L&T) practices that increase capacity within the health sector and promote the conduct of rigorous, high quality research that translates to action.

My teaching ethos focuses on directly **addressing barriers** to learning (emotional, psychological, technical, or practical). In doing so, I remove some of the stigma associated with RM subjects to facilitate **authentic, accessible and supported learning** that ultimately inspires students to learn and deeply embrace RMs as part of their professional identities.

CRITERION 1: APPROACHES TO TEACHING AND THE SUPPORT OF LEARNING THAT INFLUENCES, MOTIVATES, AND INSPIRES STUDENTS TO LEARN.

Students enrolled in JCU’s RM subjects (Epidemiology and Biostatistics) represent a diverse group in terms of age, geography, socioeconomic status, and language abilities, with vastly different learning experiences, academic backgrounds and destinations. While undergraduate students are typically resistant to and resentful of learning statistics/research,² postgraduate students tend to be highly motivated clinical health professionals, some of whom may not have participated in formal study for many years. Class sizes range from small (40-60) to large (300+), and vary in delivery mode (internal/external; semester; intensive).

Negative emotions (e.g. boredom, resentment, fear, anxiety) can impede memory and prevent learning,³ and are strongly associated with academic performance in RM subjects, and their meaningful application in the work place. In addition, self-efficacy is a key predictor in academic performance, particularly in relation to RM subjects.⁴ Hence, I employ a variety of evidence-based L&T strategies to minimise negative emotions experienced by the diverse students I teach, and to increase self-efficacy. These strategies include humour;⁵ flexibility in format/delivery,⁶ authentic and applied assessments,⁷ detailed explanations with reasoning and elaborative feedback.⁴ Ultimately, my goal is to improve engagement and learning to research.^{8,9}

CURRICULUM REDESIGN FOR INDEPENDENT LEARNING, AND TO FACILITATE EMPATHIC GUIDANCE: From 2013-2015, I substantially redesigned the curriculum for all RM subjects to create engaging, authentic, and accessible learning opportunities for students, and to align with JCU strategic intent and best, contemporary practice. My approach was informed by the [JCU curriculum framework](#), and the [6 Principles of the JCU Model](#). Curricula redesign was co-ordinated and systematic, using latest technology to foster a comprehensive,

integrated student experience. This process requires continual and active reflection. Flexibility is a key focus to ensure that students are not disadvantaged by remoteness/inaccessibility, which is an important factor, particularly for postgraduate students as many are external and living in remote areas.

"When I first saw the layout for this subject I cried. I was very nervous about not having access to the whole semester and worried about time management. The weekly access actually improved my time management. I felt really well supported from Kerrianne. Examples were current, interesting and applicable to health, making all the number crunching truly worthwhile". (Student comment, SP1, 2015.)

Curricula redesign occurred across three domains: content, delivery, assessment.

CONTENT: I embrace the teaching/research nexus by using my own and my team members' research in teaching examples, and in data for assessment. In Epidemiology, core lectures are supplemented by the "Epi in Action" series that I created with the explicit purpose of reinforcing theoretical and practical concepts in an applied, authentic way. Researchers within JCU showcase their research on various aspects of tropical health in 20-30 minute presentations intimately connected with the lecture/tutorial material (using terms and concepts covered immediately beforehand). The series itself is not directly assessable but has been appreciated by students as a learning tool: *"The best aspects of this subject were Epi in Action" and "face-to-face practical application of principles"*; *"Exceptionally well organised and taught. The lecturers were very keen and made the subject matter accessible and enjoyable to learn. They obviously put a lot of effort into the material and this showed with it being made easy to learn and deal with what can be rather difficult and dry"* (Student comments, SP2, 2016).

In addition, all material (including the text book) was updated to reflect contemporary practice and knowledge. Teaching across RM subjects is now culturally informed, and at every opportunity, Indigenous and tropical perspectives are embedded in teaching material.

DELIVERY: For externally delivered RM subjects, all lectures and tutorials are recorded in various formats, and made available electronically together with supporting notes and detailed, worked answers showing step-by-step how to perform and interpret calculations (also available electronically). Where relevant, detailed, step-by-step, demonstrations of how to perform and interpret statistical analyses using SPSS are provided in various formats to support different learning styles. This material can then be used as a learning resource in the subjects and applied in professional research. In all RM subjects, regular "consolidation" sessions are built into the curricula to maximise student engagement with and encourage mastery of the learning material.

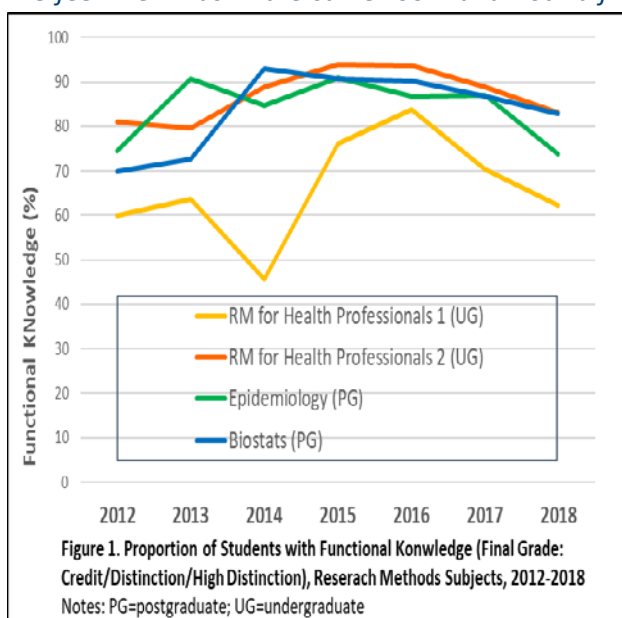
ASSESSMENT: I have created authentic assessment tasks that allow students to demonstrate their skills and knowledge; superficial assessments that rely on testing a student's memory rather than application of principles are avoided at all costs. Innovative assessment pieces (e.g., *Epi "Shark Tank"*, where students compete in groups to develop a public health strategy substantiated by evidence using relevant terms/measures/concepts learnt in the subject, then create a pitch for funding which they have to sell to judges from the "World Bank") are much enjoyed and well-received by students. In statistics-based subjects, students complete a survey at the beginning of the subject, and use their own data to apply the skills across the research cycle in class exercises and a group assignment (reflecting the real world, multidisciplinary and collaborative nature of research). These tasks were specifically designed to increase enjoyment and engagement, and to facilitate development of skills directly transferable to the workplace. In postgraduate Biostatistics and Epidemiology, the end of block/semester exams were replaced by a series of must-pass, open-book, timed quizzes, due progressively and flexibly throughout the semester. This creates immediate and simultaneous summative/formative feedback, and also scaffolded learning/assessment pieces. For all subjects, detailed worked answers are provided for all numerical exercises and assessments, which (again) students can use as a learning resource for the subject, and in their professional settings: *"Assessments and quizzes really did assess learning. Though the assessment schedule looked overwhelming at first, it really isn't. Epi really does rock!"* (Student comment, SP9, 2016).

PROVIDING SUPPORTED LEARNING: RM subjects demand a flexible and sensitive approach to teaching, with a variety of learning strategies to maximise student engagement, and inspire deep learning. The strategies I have implemented focus on making the subject material and assessment **accessible, authentic, and meaningful**, by making it **interesting, fun**, and addressing **negative emotions**. An essential component of my teaching approach is the incorporation of **humour, fun** and **compassion**, including dancing/singing, and



**Winners, Biostats 2018
Chair Dancing
Championships**

creative, interactive tasks to allow internalisation of materials,^{5,9} to reduce fear and anxiety which prevent learning,⁸ and to increase self-efficacy and improve learning.¹⁰ For this purpose, the “statistical dance of joy” (SDOJ) was introduced into the curricula (recently expanded to the “statistical chair dance of joy, for inclusivity; see photo). This concept (including demonstrations) is introduced to students as an additional sixth step of the five traditional steps of statistical hypothesis testing, to celebrate and bring alive the theory and application of statistical tests, via dancing (in a variety of genres). SDOJ is subsequently referred to wherever statistical tests are mentioned in lectures and tutorials (with live demonstrations for intensives, and recorded for external mode). Students perform their own SDOJ in class and in assessment to convey their excitement when reporting their own statistical findings. This culminates in a final championship dance-off at the end of the subject, for which there are prizes. SDOJ initially inspires scepticism, but eventually facilitates internalisation of core material. Students have embraced this approach: *“Passion for the subject, ability to simplify and provide relevant examples, interesting style including the input of statistical dance music in tutorials!, clear and thorough presentation style, highlighting of important learning points; use of “fun” analogies/musical interludes to keep interest levels in her lectures up!”* (Student comment, SP5, 2015); *“I didn’t like epidemiology before taking this subject. Now I love it so much I want to be an epidemiologist. Kerrienne’s lectures are infectiously enthusiastic. They are presented in a way that made me feel like I was in the same room and not halfway across the world. Awesome Job Kerrienne”* (Student comment SP1, 2017).



SUSTAINED IMPACT ON STUDENT LEARNING AND PROFESSION:

The impact of curriculum redesign and my personal, passionate approach to support deep learning in RM subjects is evidenced by improved and sustained student performance (Fig 1), and subject ratings from standardised institutional surveys (Fig 2; note: average survey response rates across the 4 RM subjects and years during this period was 30%, consistent with JCU average). Since my involvement from 2013, there has been a 12% average increase (from 71.3%-83.3%) in functional knowledge of Research Methods across the 4 subjects (Fig 1 – defined as proportion of students achieving Credit/Distinction/High Distinction) and a 10% reduction in fail/withdrawal rates across all RM subjects (from 11.6%-1.8%). For postgraduate students (predominantly clinicians in a position to

engage with research in daily professional lives), the proportion of students with a final grade of Distinction/High Distinction increased from 55%-67% (Epidemiology) and 52%-60.5% (Biostatistics) since my involvement. Furthermore, mean overall subject satisfaction averaged across the four RM subjects has increased from 3.6 to 4.0 (maximum=5) since my involvement (Fig 2), and for Epidemiology has been 4.4 for the last 4 years (JCU mean=3.9; maximum=5). In addition, a benchmarking exercise for Biostatistics, in which content and assessment were compared with six other Australian universities (five of which are Go8), demonstrated that the content is equivalent and assessment at least as rigorous. This was confirmed by external Peer Review of Teaching for both Epidemiology and Biostatistics, suggesting that the observed improvement in grades is real, and not an artefact of grade inflation.

Conveying enthusiasm and passion is crucial to engage and inspire students, which is particularly challenging when it comes to research methods. Teaching evaluations via standardised institutional surveys consistently demonstrate that my teaching style achieves this aim, while reinforcing grade improvements and overall satisfaction with RM subjects (**mean overall teaching (max=5) 2013: 4; 2018: 4.5; JCU average=3.9**). Responses to items specifically related to teaching style—*“Teaching style of this staff member inspired me to learn”*: mean=4.5, 91% agreement; *“staff member delivered subject material in ways that helped my learning”*: mean=4.5, 94% agreement—provide further evidence, which is supported by student feedback:

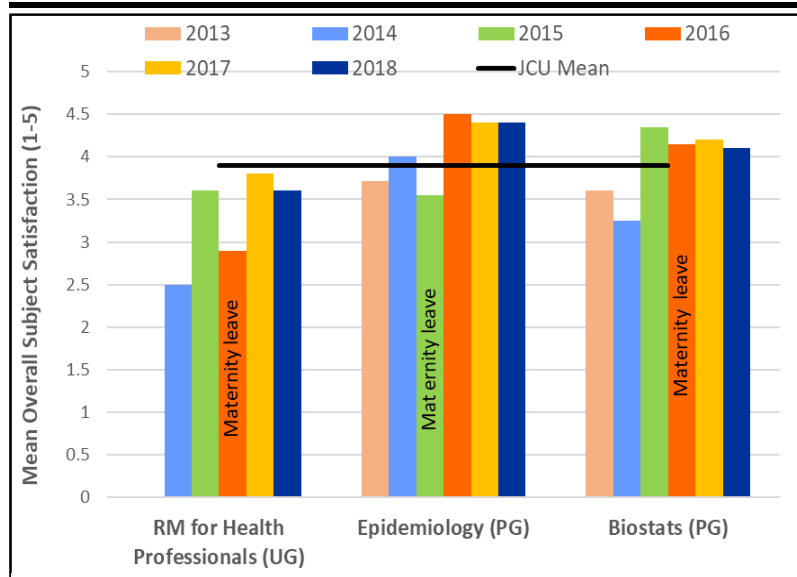


Figure 2. Mean “Overall Subject Satisfaction” (JCU Subject Survey), Research Methods Subjects, 2013-2018

“I am marvelled by your ability to teach such a complex subject and make it fun” (Student comment, Block Mode, 2019); *“You changed my thinking about epidemiology and biostatistics. You made it fun and was in such stark contrast to my undergrad experience of public health, which I disliked immensely . . . It has changed my ability to read and evaluate research in journals. It has definitely spurred my interest and turned me towards research – I landed a 50% research job next year”* (Former student, now ED doctor, unsolicited email, 2019). In Epidemiology, mean student responses to *“Delivery methods improved my understanding in this subject”* increased from 3.77 in 2013 to 4.7 (out

of 5) in 2019. In the undergraduate RM1 subject, agreement with the item *“assessment activities helped me to understand the subject materials”* increased from 38.5% in 2014, to 67% in 2018. Also in 2018, I won a JCU Citation for Outstanding Contributions to Student Learning. Broader recognition of my success in teaching RM subjects is demonstrated by invitations to present sessions on RMs at Townsville Hospital twice yearly, since 2014 and invitations to conduct similar sessions in other health service districts (e.g., Cairns Hospital): *“We have received fantastic feedback from your previous presentations”* (Manager, Townsville Hospital Research Support and Admin., email, 13 February, 2018).

CONCLUSION: My focus is on developing, evaluating, and translating evidence through learning and teaching practices that influence and promote high-quality application of RM skills in the workplace to inform excellence in clinical practice and ultimately improve public health. This evidence-based focus manifests through the content and process by which I teach. Evidence of my continuous active improvement of teaching and learning includes sustained improvement of subject and teaching evaluations, with improved student performance on all RM subjects. I have achieved this by addressing barriers to learning that remove the stigma associated with RMs, which inspires and motivates students to learn and deeply embrace RMs as part of their professional identities. Dr Margaret Chan (Director-General, World Health Organization) puts it best: *“We need more of the right kind of research, and now more than ever. We need to see health included in all policies, and we need research to make the case.”*¹¹

REFERENCES: 1. Institute of Medicine (US) Committee on Health Research and the Privacy of Health Information: The HIPAA Privacy Rule; Nass SJ, Levit LA, Gostin LO, editors. Washington (DC): National Academies Press (US); 2009. 2. Onwuegbuzie AJ. 2000. Attitudes toward statistics assessments. *Assessment and Evaluation in Higher Education*, 25, pp. 325–343. 3. Ashcraft M, and Moore AM. (2009). Mathematics Anxiety and the Affective Drop in Performance. *Journal of Psychoeducational Assessment*, 27, 197-206. doi: 10.1177/0734282908330580; 4. Luzzo DA, Hasper P, Albert KA, Bibby MA, and Martinelli EA. (1999). Effects of Self-Efficacy-Enhancing Interventions on the Math/Science Self-Efficacy and Career Interests, Goals, and Actions of Career Undecided College Students. *Journal of Counseling Psychology*, 46(2), 233- 243. doi: 0022-0167/99/; 5. Neumann DL, Hood M, and Neumann MM. (2009). Statistics? You Must be Joking: The Application and Evaluation of Humor when Teaching Statistics. *Journal of Statistics Education*, 17(2), 1-16; 6. Forte JA. (1999). Less pain, more gain. *Computers in Human Services*, 15(2), 71-87. doi: 10.1300/J407v15n02_06; 7. Pan W, and Tang M. (2004). Examining the effectiveness of innovative instructional methods on reducing statistics anxiety for graduate students in the social sciences. *Journal of Instructional Psychology*, 31(2), 149-160; 8. Onwuegbuzie A and Wilson V. 2003. Statistics Anxiety: Nature, etiology, antecedents, effects, and treatments--a comprehensive review of the literature, *Teaching in Higher Education*, 8:2, 195-209; 9. Bradstreet T. 1996. Teaching Introductory Statistics Courses so That Nonstatisticians Experience Statistical Reasoning. *The American Statistician*; 50(1); 10. Kaufman, D. M. (2003). Applying educational theory in practice. *BMJ*, 326(7382), 213-216. 11. Chan M. “Health Research Needed Now More Than Ever” Speech, delivered on November 17, 2008, Bamako, Mali. Accessed 2/13/09.