

Building Statistical Literacy for Success in Higher Education

1 January 2016 to 31 December 2016

Associate Professor Peter Howley, The University of Newcastle

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Modifications: Changed to meet WCAG 2.0 accessibility requirements.
Alternate text inserted for all images. Minor typographical errors corrected.

Higher Education Participation and Partnerships Programme (HEPPP)

2015 National Priorities Pool FINAL REPORT

Building Statistical Literacy for Success in Higher Education

1 January 2016 to 31 December 2016

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In accordance with the Conditions of Grant, you must submit to the Department a Final Report (Clause 6.1 of Part A) and an Acquittal Report (clause 6.4 of Part A).

To meet this obligation, please submit:

- the completed **Final Report** template, in Word and PDF
- the completed and signed **Declaration** form, in PDF
- the completed **Acquittal Report** template, in Excel and PDF.

All documents must be submitted to equity@education.gov.au by **31 January 2017**.

If you require additional guidance or clarification, please contact us at equity@education.gov.au.

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1. PROJECT SUMMARY (Conditions of Grant, clause 2.2(a)-(e) of Part A)

Objectives

The project had two objectives: to create, evaluate and disseminate a set of research informed digital media resources to enable students to succeed in a range of STEM and health sciences university degrees; and to support the development and understanding of statistical threshold concepts for primary and secondary students. A particular focus of the project was to enable access to these resources for low SES and culturally diverse students in rural, regional and remote locations, with the aim of increasing access and reducing attrition in higher education STEM degrees.

The participants within this project included:

- 8 academics across four universities
- 1 project manager
- 3 postgraduate & 1 undergraduate research assistants
- Over 1000 students across 32 schools, as well as 6 mentors, 19 judges, engaged with the national poster competition, with 826 student submitting posters by the due date.
- 1 team of external digital media consultants

Table 1: Project objectives

IDENTIFIED OBJECTIVE	EXTENT TO WHICH THE OBJECTIVE WAS MET
Creation of a research informed sequence of 10 innovative videos, including introductory animation designed to tackle specific areas of statistical knowledge, skills and common misunderstandings	In final stages of completion. Seven completed, three in progress. Completion date February 2017.
Development of a National Statistical Literacy campaign, including a project-based learning activity, 10 statistician expert videos and one instructional video.	National Statistical Literacy Campaign completed and continuing implementation annually.
Creation of marketing strategy	Completed.
Creation of evaluation strategy	Completed.
Unification of resources in a central interactive repository	Completed as a website www.statstuneup.com.au

Project Activities, Milestones and Key Performance Indicators

Table 2: Project activities, milestones and KPIs

TIME FRAME	PLANNED ACTIVITIES & MILESTONES	PROJECT ACTIVITIES & MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
30 Nov 2016	Concepts, storyboard, video production, interactive website and supporting resources	Completed	<ol style="list-style-type: none"> 1. Identification of content, skills and misconceptions both common and specific to STEM and health disciplines 2. Creation of 10 video concepts covering the most important items identified in 1 3. Creation of storyboards for the 10 videos 4. Production of 10 videos 5. Production of PDF resource sheets 6. Production of interactive website including quiz module 7. Project progress reports 	<ol style="list-style-type: none"> 1. Completed 2-6. In final stages of completion. Partial completion of the videos with an expected completion date in February 2017. 7. Completed
1 Aug 2016	Marketing campaign	Completed	<ol style="list-style-type: none"> 1. Creation of marketing strategy 2. Implementation of marketing strategy 3. Project progress reports 	Completed. Partial implementation in 2016 through multiple sources of dissemination (national conferences, national teacher newsletters/ journals). Implementation to be completed throughout 2017.
30 Nov 2016	National statistical literacy campaign	Completed	<ol style="list-style-type: none"> 1. Production of digital media resources 2. Development of a National Statistical Literacy Campaign 3. Implementation of a project-based learning activity 	National Statistical Literacy Campaign completed. Project-based learning activity completed. Videos in final stages of completion: partially completed. Completion date February 2017.
30 Nov 2016	Final evaluation of the project and report		<ol style="list-style-type: none"> 1. Creation of evaluation strategy 2. Implementation of evaluation strategy 3. Final report 4. Project progress reports 	Completion of evaluation strategy. Partial completion of the evaluation. Unable to complete a formal evaluation on some outputs to be first utilised by students in 2017. The evaluation will be completed in 2017 by Peter Howley and Elena Prieto as part of an in-kind contribution.

Highlights and Issues

- Creation of research informed resources to support learning, statistical knowledge, statistical skills, capacity, retention and wellbeing of students from low SES, remotely-located and culturally diverse backgrounds
- Building the capacity of these students and their peers to improve higher education access, retention and completion of tertiary STEM and health sciences degree for students who may otherwise lose connection with their programs due to statistical anxiety
- Dissemination and embedding of resources both within UoN and beyond the lead institution, and incorporating primary, secondary and tertiary levels of education
 - A communication strategy has been developed and the key tools and methods involve a combination of in-person, event-based, digital and traditional approaches such as: digital posts on the UoN and DEC website, Twitter and e-Newsletters; flyers and posters campus-wide; face-to-face sessions in tutorials, lectures and drop-in sessions; and media releases.
- Creation of digital resources and project-based learning activity that addresses key national curriculum outcomes
- Creation of resources to engage student in learning about the power of data and the careers achievable through statistics, and demystifying statistics
- Fostering interdisciplinary and cross-University collaboration
- Creation of evaluation strategy
- Creation and implementation of marketing strategy
- Exceptional feedback from teachers and students on outputs evaluated
- Total outputs:
 - 10 innovative animated online videos (digital resources)
 - 1 instructional video plus testimonials from students and teachers
 - 10 statistician 'expert' videos
 - 10 resource sheets and supporting interactive quiz modules
 - Online evaluation form
 - Evaluation strategy
 - Marketing strategy
 - Marketing report from school evaluation of prototypes
 - Posters
 - Postcards

Did the project lead to implementable outcomes? What changes will result at your institution/nationally? How is research being translated into practice? Are there activities resulting from this project that will be continued?

The digital resources will be used to develop practical skills by incorporation into first year lectures and bridging courses, embedding in web-based learning management systems, as well as on social media sites, and in first year student support packages at our institution (UoN) and nationally. The audience at UoN alone will be approximately 5,000 first year students, and a similar project (HEPP Swimming with Seahorses) has had >15,500 views on Blackboard, and >47,900 views on their YouTube channel. This project will build on the HEPP funded Maths Tune Up! website, which has had 5,556 unique visitors over 11 months, with the majority of users accessing the site through UoN. Up to 87% of visitors to the site

utilised the resource for up to 30 minutes, successfully navigated links, downloaded PDF resource sheets, and then made return visits (1.92 returns for each unique user). The outputs of this work will continue to be disseminated through national organisation's Newsletters (including but not limited to the Statistical Society of Australia, Australian Association of Mathematics Teachers), and national conferences in 2017. With the increased focus on Statistics in the NSW Education Standards Authority's Stage 6 Mathematics syllabus, these resources will be invaluable to support students and teachers in remote and rural regions, and the students' consequent success in higher education.

The National Statistical Literacy Campaign digital resources and project-based learning activity for primary and secondary students will continue to build on the success of 2016 by utilising instructional videos aimed at remote-access schools to enable teachers to implement and conduct the activity. Other digital resources include a series of Australian Industry experts explaining how the student investigation relates to the daily activity many statisticians engage in which supports the connection of remote schools with valuable information about careers and opportunities from industry experts. The project-based learning activity addresses key National Curriculum and State Board of Studies outcomes for STEM, TAS and a wide array of courses as the topics can be from any area—the key is the engagement with study design and data, problem-solving and being creative in reporting.

The level of interdisciplinary collaboration achieved from the project is invaluable and will lead to strong research and teaching links beyond the project end. Presentations by the lead investigator, Associate Professor Peter Howley, at MERGA 2016 (Adelaide), STEM Pre-service teachers conference at USyd, Newcastle Mathematics Educators' Conference 2, STEMS2016 (Putting Statistics into STEM in the Data Age) pre-conference workshop at UTS, Australian Statistics Conference 2016, OZCOTS2016 (Australian Conference on Teachings Statistics) and an awards ceremony for the National Poster Competition he hosted in Canberra, ACT, has resulted in stronger engagement with the CEO of the Australian Association of Mathematics Teachers, and development of a position paper on statistics, and additional connections with those engaging in remote and rural areas. The presentations have led to teachers contacting Peter for additional professional development in statistics, and NSW Education Standards Authority (formerly BOSTES) as well as visiting international lecturers from UAE conveying they are looking forward to utilising the output of this project to address issues of statistical anxiety and to connect teachers, schools, students at primary, secondary and tertiary levels with the importance and increased understanding of statistics. Peter has been approached to expand the delivery of the project-based learning activity, the National Poster Competition to an Oceania focus, including New Zealand. The International Statistical Institute's President-elect, Professor Helen Macgillivray, commended Peter in her keynote address at OZCOTS2016, noting the success of the project-based learning activity in connecting schools with statistics and emphasising the importance of its continuing engagement and connection with the international community. A UTS Professor and A/Prof at Macquarie University (and Vice President of the International Association of Statistics Education), who have each engaged with the National Statistical Literacy project, along with former and current Presidents of the Statistical Society of Australia are just some of the many who have expressed their wonder at the success of the National Poster Competition, and their ongoing support for its success and the value it brings, as well as identifying the value the video resources will bring

to addressing statistical anxiety in those in first year, particularly from remote and rural regions.

The Regional Development Association (Hunter) has committed to sponsor the competition, along with the Statistical Society of Australia. As part of the marketing campaign NSW Department of Education will be provided with information on the resources, plus training videos and mentor access for distribution to schools throughout the State.

Did you undertake an evaluation of your project?

Yes No

An informal evaluation has taken place for the project through focus group style interviews, where teachers and individual or groups of students were asked on video:

- “What did you like about the national poster competition activity?”
- “Would you recommend the national poster competition activity to other teachers and why?”

The complete informal qualitative and quantitative evaluation of the project is to take place with students (n=60), and teachers (n=10) from 4 schools in 3 regions after school resumes in 2017.

An evaluation of the extent of the ongoing impact on teaching, learning, student success and retention would require an additional twelve months timeframe and funding. This would be invaluable as it would assist in developing principles for engaging low SES and other non-traditional students with multiple positions of disadvantage to support learning and increased participation and retention rates.

Please summarise the findings and attach the evaluation report.

The data collected in relation to the National Statistical Literacy Campaign took the form of informal, one-on-one and group interviews after participation in the project-based learning activity which has two streams comprising of the International Poster Competition, and the Stats Tune Up digital resources.

All participants were extremely positive about the help the project-based learning activity gave them in developing statistical foundations, an overall confidence in their ability to understand the power of data, and a sense of statistics being accessible and comfortable for them and of achievement and/or improved academic self-efficacy.

A teacher who has worked out at Parkes and taught for five years in regional and rural areas and to those with low SES backgrounds commented:

“It’s definitely a project I’d get involved with if I was teaching out there again. You’ve got a lot of students who are interested in sport, they’ve got strong views on cultural and environmental issues. Giving them the opportunity to dive into those topics and have a look at the mathematics and the data...they’d enjoy it. Similar to what we’re doing here, I think it’s something the teachers would enjoy too. It works really well with the syllabus.”

Another participating teacher who has taught extensively in remote and rural regions stated:

"I like that the activity gives children purpose for their learning...that it lets them work collaboratively on something that they get to choose. I like that it has a real audience, in that there's a competition at the end, there could be prizes, they'll at least get a certificate."

"I have definitely spread the word through my network through MANSW and all my contacts with maths teachers across the country. Highly recommend it as it gives purpose, passion, productivity to the work."

"I think it's (statistics) a real key 21st century skill that all students need and the poster competition project is a great vehicle for getting that in there."

Another participating teacher who will be teaching in remote and rural regions from 2017 stated:

"I liked that it was very open-ended...It actually got them to identify with local issues and issues that were important to them"

"It would be useful in remote areas and I myself next year am going to teach in a remote area and also in a very small school...it would be relevant for children in those areas to look at environmental issues"

"Statistics helps to shape society, it helps us to give information to new issues, to find out more information about issues and to inform society"

Students also commented what they like about the National Statistical Literacy project-based learning activity:

Male Year 10 *"it's quite fun, challenges us, ...it really puts you out of your comfort zone... it was good"*

Female 1 Year 7 *"You can do what interests you. You can work with people who have the same interests as you"*

Male 1 Year 7 *"It uses statistics in a fun way"*

Female 2 Year 7 *"It gives you a chance to do what you're interested in instead of doing set work that you may find boring and may not want to complete"*

Male 2 Year 7 *"It's really interesting as it's not something we usually get to do. ... It was more interesting and engaging...doing what our ideas are rather than having a set basis of what we have to do."*

Female 3 Year 7 *"you can be as creative as you want, and pretty much can choose your own topic, for example I like music and how sometimes it affects how you feel. ...I find it amazing that you can just be who you are by using your opinions."*

When students were asked whether they would recommend it to others, and why, they responded:

Female 2 Year 7 *“It gives you a chance to do something you’re interested in while still learning at the same time”*

Female 1 Year 7 interjected *“And it’s fun, and then you can make a poster”*

Male 1 Year 7 interjected *“And you can talk about your pets, it’s good”*

Male 2 Year 7 *“It’s really engaging so if I found it, ya know, pretty cool then I think others would too...Finding it fun, doing what they want to do, putting their ideas into play...it’s a really good opportunity.”*

Female 2 Year 7 *“I find I’m enjoying it, I’ve never actually had an opportunity to do something like this before. Doing something that’s national is just amazing.”*

An A/Prof in Education at USyd has endorsed the National Statistical Literacy Program, and invited A/Prof Howley to present at a STEM pre-service teachers conference about the activity. A UTS Professor in Statistics and A/Prof in Statistics at Macquarie University (and Vice President of the International Association of Statistics Education), who have each engaged with the National Statistical Literacy project, have described the digital resources produced as “very cool” and “engaging” and “will assist time poor students and those in remote and regional areas where blended learning is critical”.

After students return to school in 2017, the resources will be tested by approximately 60 students in Years 11-12, from four schools located at regional, rural and remote locations. Schools were selected using ICSEA and postcode. Implied consent will be given by the completion of an online, anonymous survey, containing some open-ended questions. A copy of the evaluation tool is provided in Appendix A.

Students will view in class time two of the created animations, engage with the interactive website, and receive the supporting resource sheet. Viewing the videos and website will take 10 minutes. Completing the survey will take approximately 15 minutes. The class teacher or a research team member will administer the survey and facilitate viewing of the resources. The survey was developed in consultation with UoN academics, and measures included usefulness of the video content, participant experiences with the website and effectiveness of the quiz modules.

Where applicable, indicate number of the following resulting from this project:

Student contacts	>10,000 expected (2017)
Journal (or other publication) submissions	In progress (2)
Conference Presentations	4
Websites developed	1 www.statstuneup.com.au
Educational or marketing campaigns	1
Schools engaged	50
Parental/family contacts	>830

Describe any issues that occurred during the year and any mitigation strategies you implemented.

The evaluation was unable to be fully completed as the finalised resources were not available to students in sufficient time prior to the end of Term 4 (students were engaging in other non-class activities near Term 4 end). The evaluation will be conducted after school resumes in February 2017.

Peter Howley and Elena Prieto as part of an in-kind contribution will also undertake a further assessment of the extent of impact on teaching, learning, student success and retention through an assessment of the resources in undergraduates engaging in studies in 2017.

2. OTHER PROJECT MATERIAL (Conditions of Grant, clause 2.2 (b)-(e) of Part A)

Table 3: Additional materials produced over the course of the project

TYPE	AUTHOR	DATE OF PUBLICATION	PUBLICATION DETAILS
Website			www.statstuneup.com.au
Resource sheets			www.statstuneup.com.au
Quiz module			www.statstuneup.com.au
Evaluation strategy			Attached
Online evaluation form			Attached
Marketing strategy			Attached

3. ACQUITTAL REPORT (Conditions of Grant, clause 6.4(e), clause 6.7-8 of Part A)

Have you fully expended the Grant Funds provided under the Conditions of Grant?

Yes No

If the answer is No, please specify:

- *the amount of funds remaining: \$*
- *the reason for this underspend:*

Ensure that the completed Acquittal Report template is signed by an appropriate university officer and attached to this Final Report.

**IMPORTANT NOTICE - Unspent 2015 National Priorities Pool Grant Funds*

- *Grant recipients must fully expend these 2015 National Priorities Pool funds in the project period for which the grant is made and report on this expenditure to the Commonwealth, including the amount of any unspent funds.*
- *If a provider fails to spend the full amount granted it in respect of a year, the unspent funds may be recovered by the Commonwealth.*

DECLARATION

I declare that:

- I am authorised by the university to sign this Declaration on its behalf, and
- to the best of my knowledge, the information that I have provided in the **Final Report** and **Acquittal Report** for the HEPPP 2015 National Priorities Pool project *Building Statistical Literacy for Success in Higher Education* is true, correct and accurate in all particulars.

I understand that:

- The provision of false or misleading information or the making of false or misleading statements to the Commonwealth is a serious offence under the *Criminal Code Act 1995 (Cth)*.
- If any actual or potential conflict of interest arises, I must notify the Commonwealth immediately in writing of the facts giving rise to the actual or potential conflict of interest and to take such steps as the Commonwealth may require so as to resolve or otherwise deal with any conflict of interest that may arise.

I agree to publication of the Final Report on the Department of Education and Training website, once accepted by the department.

Title	Professor
Name	Liz Burd
Position	Acting Deputy Vice-Chancellor (Academic)
Signature	

APPENDIX A: Project Evaluation – Research Design

INFORMAL EVALUATION

The complete informal qualitative and quantitative evaluation of the project is to take place with students (n=60), and teachers (n=10) from 4 schools in 3 regions after school resumes in 2017.

The resources will be tested by approximately 60 students in Years 10-12, from four schools located at regional, rural and remote locations. Schools were selected using ICSEA, postcode and accessibility. Invitation to participate is by an email to the class teacher, known to the CIs. Implied consent will be given by the completion of an online, anonymous survey, containing some open-ended questions. Students will view in class time during a maths period two of the created animations, engage with the interactive website, and receive the supporting resource sheet. Viewing the videos and website will take approximately 10 minutes. Completing the survey will take approximately 15 minutes. The class teacher or a research team member would administer the survey and facilitate viewing of the resources.

1. Supporting Documents

Online survey instrument.

FORMAL EVALUATION

2. Research Questions

The project objective is to create, evaluate and disseminate a set of research informed digital media resources to support learning, statistical knowledge, statistical skills, capacity, retention and wellbeing of students from low SES, remotely-located and culturally diverse backgrounds

Building the capacity of these students and their peers to improve higher education access, retention and completion of STEM and health science degrees for students who may otherwise lose connection with their programs due to statistical anxiety. The project will draw on the experiences and expertise of teaching academics in Engineering, Education, Mathematics and Science, who recognise the challenges faced by students from low SES backgrounds and the possibilities for improving their experiences at tertiary level.

Aims:

1. To create resources that are research informed
2. Help STEM university students from low SES backgrounds succeed in statistics
3. Improve their experiences at tertiary level

3. Methodology

The research will be divided into 3 phases

1. Creation of Resources,
2. Testing of Resources, and
3. Implementation of Resources.

A graphical representation of the Methodology as will be implemented for each Aim of the project can be found in Figure 1.

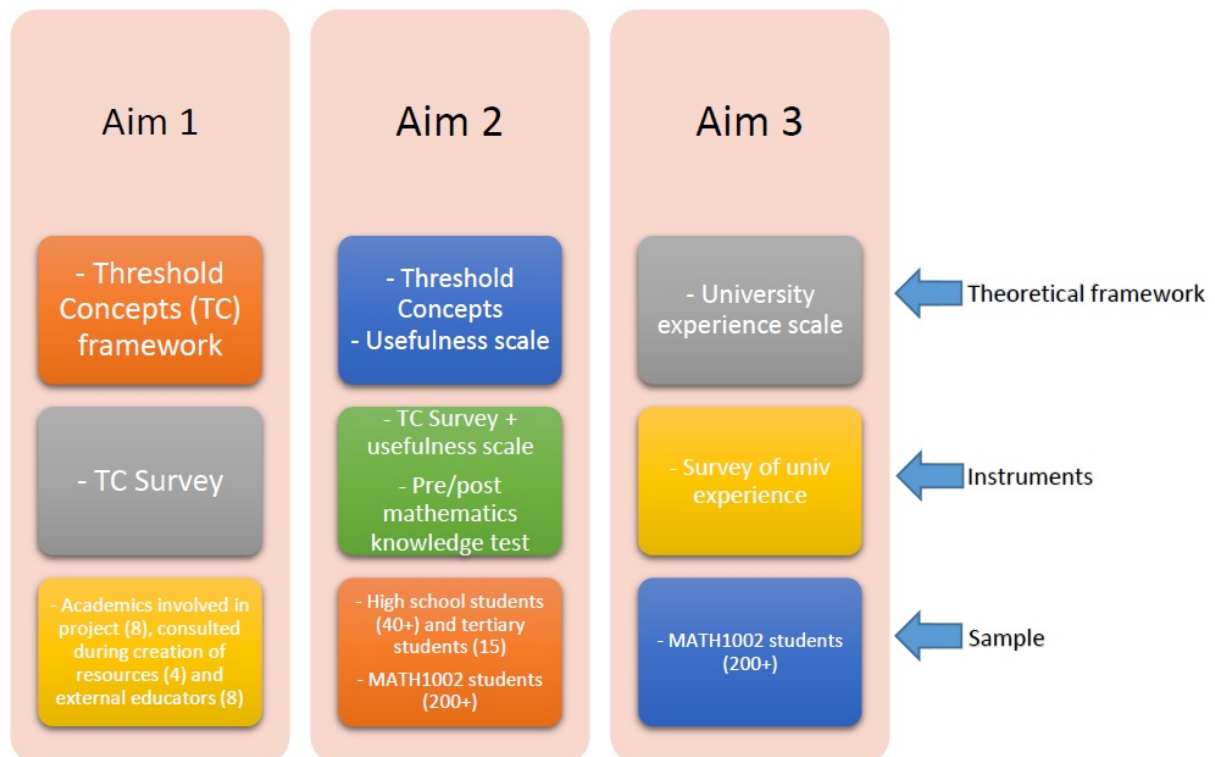


Figure 1: Methodology

3.1 Methods

The first aim of the project will be investigated in Phases 1 and 2 using the TC framework. To this end, all people involved in the creation of resources in Phase 1 will be surveyed as well as a group of educators and experts involved in testing in Phase 2. The instrument used will be Instrument 1 (see below). The survey will be online, anonymous, with some open ended questions and approximately 20 minutes in duration. It will be administered to academics involved in Phase 1 and Educators in Phase 2.

The second aim of the project will be investigated in Phases 2 and 3 using both the TC framework and a usefulness scale.

Students involved in the testing of the resources in Phase 2 will be tested on mathematical knowledge before and after watching the videos (students will respond to Instrument 2.1 before watching the videos, and after watching them, they will respond to Instrument 2.2.). The test and associated short survey will be paper-based and will contain expanded response mathematical items (short, but not multiple choice) and Likert-type items. It will take approximately 30 minutes to complete each of the tests.

In the case of students in Phase 2, the testing phase, the time between the tests will be three weeks. Also, focus groups will also be conducted to test the appropriateness of the videos. In this case the Threshold Concepts framework will be used.

In the case of students in Phase 3, the implementation phase, Instrument 2.1 will be delivered before Week 3 and Instrument 2.2 after the mid-semester break.

The third aim of the project will be investigated in Phase 3 using surveys and interviews about their university experience. Students participating in Phase 3 of the project will be surveyed about their university experience and the role of mathematics in it. Given the larger sample size for Phase 3 a survey might be sufficient and then target a few students for interviews based on their survey responses – some who liked the videos and accompanying online resources, some who were indifferent and some who didn't find them useful.

3.2 Sample by Phase

3.2.1 Phase 1:

- Academics involved in the project (8)
- Academics and teachers (10)

3.2.2 Phase 2:

- Educators
 - People involved in rural and remote education (6+)
 - IMSITE education academics (4+)
- Students
 - Students from rural and remote high schools (60+)
 - Students in university Enabling program, EPMTH309, EPMATH125 courses (15+)
 - Students in first year university Health Sciences, or STEM programs (40+)

3.2.3 Phase 3:

- Sample of science and engineering students in MATH1002 (200+)

3.3 Instruments

3.3.1 Instrument 1:

Substantive survey using Threshold Concepts framework.

Sample Questions

QUESTION	THRESHOLD CONCEPTS FRAMEWORK
Which of the videos do you consider present knowledge that is transformative?	TRANSFORMATIVE KNOWLEDGE: The video can potentially involve a conceptual shift in the way students think about the mathematical topic
Which of the videos do you consider present knowledge that is irreversible?	IRREVERSIBLE KNOWLEDGE: The video's concept, once understood, will not be forgotten
Which of the videos do you consider present knowledge that is integrative?	INTEGRATIVE KNOWLEDGE: The video exposes the interrelatedness of the concept to other concepts in mathematics or STEM

QUESTION	THRESHOLD CONCEPTS FRAMEWORK
Which of the videos do you consider present knowledge that is bounded?	BOUNDED KNOWLEDGE: The video delineates a conceptual space. Boundedness may be associated with a discipline's special language
Which of the videos do you consider present knowledge that is troublesome?	TROUBLESOME KNOWLEDGE: The concepts the video is trying to explain may appear to students as counter-intuitive or 'hard'
Did you find video/resource #X useful?	
Would you recommend video/resource #X to other people?	
Would you use video/resource #X in your teaching practice?	
Positive characteristics of the videos	
Negative characteristics of the videos	
Other videos	
Areas of improvement	

3.3.2 Instrument 2:

3.3.2.1 Instrument 2.1

Short statistics knowledge test + demographics.

Students are advised how to create unique anonymous and easily repeatable identifier in order to match pre- and post- data.

3.3.2.2 Instrument 2.2

Short statistics knowledge test (2) + additional questions about how much they have like videos or found them useful.

Students are advised how to use their unique anonymous and easily repeatable identifier in order to match pre- and post- data.

- Did you find the video useful?
- Would you recommend it to other people?
- Areas of improvement
- Positives
- Negatives

3.3.3 Instrument 3:

Questions about statistics experience at tertiary level.

Students are advised how to use their unique anonymous and easily repeatable identifier in order to match pre- and post- data.

- Are you enjoying university life?
- Are you enjoying learning statistics?

4. Analysis

- Consider differences (before and after video/resources intervention)
- Consider relationships between mathematical knowledge/usefulness of videos and resources/enjoyment of university life

5. References

Meyer, J. (2008). *Threshold concepts within the disciplines*: Sense publishers.

Meyer, J., & Land, R. (2003). *Threshold concepts and troublesome knowledge: linkages to ways of thinking and practising within the disciplines*: University of Edinburgh Edinburgh.

APPENDIX B: Stats Tune Up! Marketing and Stakeholder Engagement Plan 2017

Version 4.0

Background

The HEPPP grant scheme delivers funding to providers to undertake activities and implement strategies that improve access to undergraduate courses for people from low SES, rural, remote and culturally diverse backgrounds to improve their retention and completion rates.

The project's objective is to develop and pilot a series of integrated digital media resources that are aimed at supporting a national statistical literacy initiative to enable access and facilitate success within a range of university degrees in STEM and the health sciences. The project will also support the development and understanding of statistical threshold concepts for primary and secondary students. This project is a cross-Faculty, and cross-Institution collaboration drawing on the expertise of academics in Mathematics, Education and Engineering.

Outputs

- Ten animated videos which can be found at www.statstuneup.com.au to complement the existing 'Maths Tune Up!' website at www.mathstuneup.com.au
- Practice questions with solutions and working out, plus downloadable resource sheets that summarise each topic
- Three instructional videos for the international statistics poster competition
- Ten statistician 'expert' videos
- One interactive website with mobile/tablet compatibility.

The videos follow an animation style, are divided into categories corresponding to key national curriculum outcomes, and address key statistical concepts known to be roadblocks for STEM and health science tertiary students.

The video resources are significantly different from existing concepts currently used by students such as Khan Academy or patrickjmt.com, and build on a previous project 'Maths Tune Up!'. The conceptual idea is to follow highly engaging techniques which have already proven successful with low SES students by adapting them to mathematical content.

The digital resources will be used to develop practical skills by incorporation into first year lectures and bridging courses, embedding in web-based learning management systems, as well as on social media sites, and in first year student support packages at our institution (UoN) and nationally. The audience at UoN alone will be approximately 5,000 first year students, and a similar project (HEPPP Swimming with Seahorses) has had >15,500 views on Blackboard, and >47,900 views on their YouTube channel. This project will build on the HEPPP funded Maths Tune Up! website, which has had 5,556 unique visitors over 11 months, with the majority of users accessing the site through UoN. Up to 87% of visitors to this site utilised the resource for up to 30 minutes, successfully navigated links, downloaded PDF resource sheets, and then made return visits (1.92 returns for each unique user).

The outputs of this project will continue to be disseminated through national statistics and mathematics organisation's Newsletters (including but not limited to the Statistical Society of Australia, Australian Association of Mathematics Teachers), and national conferences in 2017. With the increased focus on Statistics in the NSW Education Standards Authority's Stage 6 Mathematics syllabus, these resources will be invaluable to support students and teachers in remote and rural regions, and the students' consequent success in higher education.

The National Statistical Literacy Campaign digital resources and project-based learning activity for primary and secondary students will continue to build on the success of 2016 by utilising instructional videos aimed at remote-access schools to enable teachers to implement and conduct the activity. Other digital resources include a series of Australian Industry experts explaining how the student investigation relates to the daily activity many statisticians engage in which supports the connection of remote schools with valuable information about careers and opportunities from industry experts. The project-based learning activity addresses key National Curriculum and State Board of Studies outcomes for STEM, TAS and a wide array of courses as the topics can be from any area—the key is the engagement with study design and data, problem-solving and being creative in reporting.

Communications objectives

- Create and maintain awareness and understanding of the Stats Tune Up resources, the opportunities they provide for success, and the benefits of engagement with the resource to academics and students
- Provide a clear call to action for the university and school community to disseminate to students, particularly to those from low SES backgrounds, or from regional and remote areas
- Increase STEM and health science degree retention through mobilising academics, students, principals, and other key stakeholders to utilise the resource
- Establish and maintain supportive relationships within UoN and the broader STEM/health sciences community
- Build on inspiring low SES, culturally diverse and remotely based students to increase their interest in and access to higher education
- Ensure the UoN and Stats Tune Up marketing strategies are aligned with one another
- Deliver a focus on demystifying statistical notions to make statistics more appealing and accessible
- Disseminate information to schools, organisations and media regarding the learning-based activity supporting a national statistical literacy campaign

Key messages – overarching

- A sound knowledge of a range of mathematical concepts has often been identified as a major factor in enabling university students to gain access to and succeed in degrees involving health science, technology, engineering and maths
- Understanding statistical concepts and acquiring statistical skills are critical to access and succeed in these degrees
- Many health science and STEM students, especially those from a low socioeconomic (SES) background have statistical anxiety which is a barrier to completion

- Students can revisit some of the basic concepts in maths whenever and wherever they like by visiting the Stats Tune Up website to develop their confidence
- Each video provides a short reminder of a different statistical concept, runs for just a few minutes, and includes easy-to-follow explanations and examples
- As well as the videos, the Stats Tune Up website features practice questions with solutions and working out, plus downloadable resource sheets that summarise each topic
- The resource aims to increase equity for disadvantaged students by assisting them to overcome learning difficulties, stay at university and successfully complete their degree
- The resources are available 24/7 to anyone who wants to use them.
- The core values of Stats Tune Up are access, discovery, engagement, and learning
- Stats Tune Up is inclusive of everyone in the learning community
- Stats Tune Up allows for everyone's skills to be used in a positive and constructive manner
- A project-based learning activity will be used to support the resource and provide opportunities for students to engage with statistics, understand the power of data, and recognise the daily activities of statisticians and scientists
- The project-based learning activity addresses key National Curriculum learning outcomes and provides an opportunity to develop creativity, data investigation, critical thinking, collaboration and communication skills
- Digital resources including instructional videos showing how to conduct the activity, and online mentors will support the activity and remediate geographical barriers for rural or remote schools
- Industry expert videos explain how students' investigations relate to, and are a smaller scale version of their own work in health science or statistical fields.

Stakeholder analysis

There are a number of broad groups of stakeholders to inform about the resource, and who can help provide opportunities to further promote the collection.

- The University of Newcastle
 - Representatives from engineering (Bill McBride)
 - Representatives from statistics and maths (Peter Howley – STAT1070, MATH1110)
 - Representatives from education (Elena – MATH1001, MATH 1002)
 - Representatives from CTL (Ben Brawn, Fran Taylor)
 - Representatives from sciences (Peter Howley to liaise)
 - CEEHE and enabling programs (Sharon Cooper EPMATH309, EPMATH125)
 - Student counsellors and student services (Cheryl Burgess)
 - Current and prospective UoN STEM and Health Sciences students (Cheryl Burgess)
 - CEEHE (Belinda Munn)
- Other universities (Profs Kath Holmes WSU, Michael Martin ANU, A/Prof Peter Dunn USC)
- NSW DEC

- Associations for maths and statistics (for example, Statistical Society of Australia, Australian Association of Mathematics Teachers)
- IMSITE education academics
- Corporate organisations who promote statistics, maths and science to their staff or own stakeholders
- General community members
- Funding bodies.

Communication and engagement methods and tools

The key tools and methods are listed below:

- Stats Tune Up website
- NSW DEC website
- UoN Faculty and school digital newsletters
- UoN, USC, WSU, ANU staff and interinstitutional colleagues
- National organisations' newsletters
- National conference presentations
- Social media
- Traditional media
- Communications from UoN
- Media launches
- Media releases
- Promotional collateral
- Regular communication to stakeholders through e-newsletters, face-to-face meetings and phone calls

Please refer to the Engagement Plan for a detailed timeline of the following engagement methods.

UoN website

- Digital screens including lecture screens
- Blackboard announcements
- Social media announcements

University, Faculty and School websites/newsletters

- Announcements for InTheLoop
- Faculty e-newsletter
- School e-newsletters

DEC school website/newsletter

- School Biz – Gary Hartin/Cheryl Best

Traditional media

- Postcards and posters at student hubs, library and around campus
- Banner and article in YAK

- Media release to news outlets when appropriate policy or news-worthy article appears
- ABC radio
- The Conversation article

UoN lectures and tutorials

- Several face-to-face sessions before mid-semester break that could be conducted by a second or third year student instead of an academic. See if it is possible to access records of students struggling in maths or sciences to send out a targeted invite.
- PowerPoint slides and guide emailed to academics to include in lectures and tutorials
- Meetings with Faculties so they are aware of initiative. Science & IT run a Maths program for struggling students

School presentations

- Liaise with UoN student recruitment about targeting year 12 students and possibilities of doing some 'live chat' sessions or similar after students have accepted their offer.

There are four major conduits to focus on throughout 2017: promotion to academics, teachers, students, and wider science, maths and statistical community. Working in partnership with CEEHE and our interinstitutional partners, we will increase knowledge of the resource throughout the university community which will have a positive impact on the promotion and utilisation of the resource by students. By providing students opportunities to participate in independent learning and build their statistical skills, Stats Tune Up will increase self-esteem and completion pathways.

2017 key directions

TIMEFRAME	TARGET GROUP	RATIONALE	KEY TASKS	KEY PRODUCTS
Feb-Mar	Academics, teachers, professional staff and STEM/health sciences students	<p>To provide academics, teachers and students with a knowledge of the resource to reduce challenges faced by students from low SES backgrounds and to improve their experiences at tertiary level.</p> <p>Academics and teachers have limited time to develop targeted learning resources. Stats Tune Up could assist by providing an all in one tool to support the development and understanding of statistical concepts.</p>	Create partnerships with academics, schools, teachers and professional staff to promote to students	<ul style="list-style-type: none"> Media promotion Lecture promotion Product utilisation
Feb-April	Teachers and parents	<p>Stats Tune Up could assist organisations, schools, parents and students by providing a free, easy to access e-learning tool to support learning statistical concepts.</p> <p>Usage of the resource can aid future UoN STEM and health sciences student success and retention.</p>	Create partnerships with schools, P& C groups, out of school homework groups. Engage teachers and parents	3 case studies on student participation teachers and parents will find most valuable
April-August	Students	<p>Stats Tune Up will allow students to develop their skills, increase their self-esteem and university pathway completion.</p> <p>A project-based learning activity will be used to support the resource and provide opportunities for students to engage with statistics, understand the power of data, and recognise the daily activities of statisticians and scientists</p>	<ul style="list-style-type: none"> Student recruitment drive Stats Tune Up poster competition School visit days 	<ul style="list-style-type: none"> Stats Tune Up media promotion of National Poster competition. Attendance at remote and rural schools in May 2017. Case studies showcasing student participation UoN Market Days UON Popup stalls UoN School Visit Days
August- December	Broader statistical community partnerships	<p>Widespread statistical community participation and support will result in the utilisation of the resource</p> <p>Contacts:</p> <ul style="list-style-type: none"> Australian Council of Deans of Science Teaching Aust. Mathematical Sciences Institute 	Attend at least two major conferences within Australia to promote the resource and National Poster Competition	<ul style="list-style-type: none"> Conference presentation Case studies showcasing achievements of projects Publication of journal articles

		<ul style="list-style-type: none"> • Aust. Mathematical Society • Statistical Society of Australia • Science and Mathematics Network of Australian University Educators • Community for Undergraduate Learning in the Mathematical Sciences 		
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Communications and stakeholder engagement activities

TIMEFRAME	OPPORTUNITY	DETAILS	PRODUCTS	EXPECTED REACH
22 February	UoN Workshop and site launch	<ul style="list-style-type: none"> • Showcase and launch Stats Tune Up: how it operates, the benefits, share case studies • Feature students who have benefited from Stats Tune Up, or Maths Tune Up as well as the National Poster Competition <p><i>Requires partnership management with UoN Student Central, Enabling, and CEEHE</i></p>	<ul style="list-style-type: none"> • Media release • Distribution list • Provide photo to accompany media release • Develop information package to provide to participants • Twitter and Facebook updates 	<ul style="list-style-type: none"> • 50 face-to-face • 200 hits on website
22 February	<i>O'Week Shortland Union</i>	<ul style="list-style-type: none"> • <i>Promote Stats Tune Up to students using examples of benefits and use</i> • <i>Provision of promotional collateral on CEEHE, NewStep and Student Central stalls</i> <p><i>Contact: Cheryl Burgess</i></p>	<ul style="list-style-type: none"> • Photo opportunities • Develop relevant student orientated usage stories • Twitter and Facebook updates (UoN) 	<ul style="list-style-type: none"> • 500 (postcards & face-to-face) • 300 hits on website
February – March	NSW DEC Newsletters	<ul style="list-style-type: none"> • Promote Stats Tune Up in DEC Newsletters • Arrange suitable Stats Tune Up events such as workshops for teachers as required <p><i>Contact: Gary Hartin, Cheryl Best</i></p>	<ul style="list-style-type: none"> • Develop Stats Tune Up! Stories • Media release for any events • Photo/film opportunities, as suitable • Twitter and Facebook updates 	<ul style="list-style-type: none"> • 49,000 FTE teaching staff have access • 490 hits on website
February – March	University recruitment drive	<ul style="list-style-type: none"> • Meet with UoN program convenors to identify programs that can engage in Stats Tune Up • Assist program convenors to set up Stats Tune Up for lectures • Promote Stats Tune Up opportunities through collaboration with broader university networks 	<ul style="list-style-type: none"> • Template letter to program convenors • Distribution list • Promotional collateral support student needs • Radio segment promotion 	<ul style="list-style-type: none"> • 50 program convenors contacted • 50 hits on website from

TIMEFRAME	OPPORTUNITY	DETAILS	PRODUCTS	EXPECTED REACH
			<ul style="list-style-type: none"> Develop article for UoN digital newsletters (Faculty and School) Twitter & Facebook updates 	<ul style="list-style-type: none"> mailout/face-to-face meetings
6 March (ongoing throughout March and April)	Stats Tune Up National Poster Competition campaign commences	<ul style="list-style-type: none"> Highlight how Stats Tune Up and the National Poster Competition can assist through case studies based on key curriculum concepts Attend P&C meetings, school meetings to engage principals to promote the benefits of Stats Tune Up to parents and students Provide promotional collateral to educational facilities, and other external homework groups as required Encourage stakeholders to promote Stats Tune Up through newsletters, social media and traditional media <p><i>Related events: Announce schools involved - June; Closing reminder – July; Award ceremony - November</i></p>	<ul style="list-style-type: none"> Develop organisation specific case studies/ articles for newsletters (schools, homework groups) Photo and film opportunities Media release(s) Provide photo to accompany media release(s) Template letter to schools promoting opportunities Stats Tune Up provides Distribution list Promotional collateral as required Twitter and Facebook updates 	<ul style="list-style-type: none"> 9,300 schools contacted 1500 participants in competition 200 website hits
March	University and TAFE student and staff recruitment drive	<ul style="list-style-type: none"> Promote the benefits of Stats Tune Up to tertiary students Encourage students and staff to utilise the resource Encourage students and staff to like Facebook page and follow on Twitter Hold info sessions at student associations Identify how Stats Tune Up can assist students and opportunities for staff through case studies <p><i>Requires partnership management with UoN Student Central, Enabling, CEEHE and collaborators at other universities (ANU, WSU, USC)</i></p>	<ul style="list-style-type: none"> Distribution list Template letter Media release ABC Radio segment promotion Photo/film opportunity Digital screen, Twitter and Facebook updates Information popup stall (if suitable - TBC) 	<ul style="list-style-type: none"> 4,500 students reached via email 50 attended sessions 200 website hits
15 March	NSW PPA meeting	<ul style="list-style-type: none"> Introduce Stats Tune Up and the National Poster Competition Promote benefits both can provide to students using case studies 	<ul style="list-style-type: none"> Media release Develop relevant student orientated case studies Twitter and Facebook updates 	<ul style="list-style-type: none"> 5,000 primary schools receive minutes 200 website hits
Mid- March	UoN BBQ – Student Central	Promote benefits Stats Tune Up can provide to students using case studies	<ul style="list-style-type: none"> Photo opportunities 	<ul style="list-style-type: none"> 20 attendees 20 website hits

TIMEFRAME	OPPORTUNITY	DETAILS	PRODUCTS	EXPECTED REACH
			<ul style="list-style-type: none"> • Develop relevant student orientated case studies • Twitter and Facebook updates • Develop story for UoN newsletters • Website updates 	
24 May	ACSP State Conference	<ul style="list-style-type: none"> • Promote Stats Tune Up and the benefits the National Poster Competition provides to students • Promote benefits Stats Tune Up can provide to students using case studies 	<ul style="list-style-type: none"> • Media release • Distribution list • Develop relevant student orientated case studies/conference presentation • Twitter and Facebook updates 	<ul style="list-style-type: none"> • 1700 schools invited • 200 website hits
13 June	NSW Secondary Principals Conference	<ul style="list-style-type: none"> • Promote Stats Tune Up and the benefits the National Poster Competition provides to students • Promote benefits Stats Tune Up can provide to students using case studies. 	<ul style="list-style-type: none"> • Media release • Distribution list • Develop presentation • Develop information package for participants • Distribute information to program stakeholders • Twitter and Facebook updates 	<ul style="list-style-type: none"> • 1700 invited • 150 website hits
11 July	AAMT Conference	<ul style="list-style-type: none"> • Promote Stats Tune Up and the National Poster Competition provides to students • Promote benefits Stats Tune Up can provide to students using case studies. 	<ul style="list-style-type: none"> • Media release • Distribution list • Develop presentation • Develop information package for participants • Distribute information to program stakeholders • Twitter and Facebook updates 	<ul style="list-style-type: none"> • 4500 members invited • 200 website hits
12 September	Primary Principals National Conference	<ul style="list-style-type: none"> • Promote Stats Tune Up and the National Poster Competition provides to students • Promote benefits Stats Tune Up can provide to students using case studies 	<ul style="list-style-type: none"> • Media release • Distribution list • Develop presentation • Develop information package for participants 	<ul style="list-style-type: none"> • 4800 invited • 200 website hits

TIMEFRAME	OPPORTUNITY	DETAILS	PRODUCTS	EXPECTED REACH
			<ul style="list-style-type: none"> Distribute information to program stakeholders Twitter and Facebook updates 	
September (TBC)	UoN Ourimbah	Encourage wider community to attend to learn more about the opportunities Stats Tune Up National Poster Competition provides	<ul style="list-style-type: none"> Media release Photo/ film opportunity Radio segment promotion Twitter and Facebook updates 	<ul style="list-style-type: none"> 20 attendees 20 website hits
11 December (TBC)	<ul style="list-style-type: none"> AustMS conference OzCots conference National Poster Competition Awards 	<ul style="list-style-type: none"> Showcase the impact of the National Poster Competition on student learning Recognise efforts of the participants and mentors and award prizes. Call for more involvement from schools 	<ul style="list-style-type: none"> Media release Targeted interviews Photo opportunity at conference Develop and share case study Twitter and Facebook updates 	<ul style="list-style-type: none"> 1 conference presentation 1 award ceremony 250 audience reach
Ongoing	ABC radio national segment on statistical anxiety	Segment when relevant news article emerges	Radio interview segment	<ul style="list-style-type: none"> 1 radio segment 8,000 audience reach
Ongoing	PASS sessions	Sessions with peer tutors	Face to face	10 sessions held

Attachments

1. Template letter
2. Media release
3. Practice Guide
4. PPT slides (not included: pending site completion)
5. Dissemination tracking table

Supporting files

1. Course convenors: Australian Universities (Maths, Bridging programs, Engineering, Health, Education)
2. Australian High School Principals (ACARA)
3. Australian Primary School Principals (ACARA)

1. Template letter/email

Good morning. A series of animated 3-minute videos designed to help university students develop their statistics skills is now available on the new Stats Tune Up! website. The videos cover a wide range of essential statistical concepts that first year students need in order to progress with their studies. The website also features practice questions with full working out, plus downloadable resource sheets that summarise each topic. Attached is a guide to introducing the resource to students, as well as three PowerPoint slides that may be used at the commencement of a lecture or tutorial.

Stats Tune Up! was created at the University of Newcastle with funds from the Commonwealth Government's Higher Education Participation Programme, which aims to improve equity and access to higher education.

Stats Tune Up! can be found at www.statstuneup.com.au

For further information about Stats Tune Up! contact A/Prof Peter Howley on peter.howley@newcastle.edu.au or phone +61 2 4921 5518

2. Media release

MEDIA RELEASE

New statistics videos and website designed to help students succeed at university

A series of animated videos designed to help university students develop their statistics skills is now available on the new Stats Tune Up! website created by the University of Newcastle.

The videos, which can be found at www.statstuneup.com.au, cover a wide range of statistical concepts that students need to understand in order to stay on top of their studies.

Each video provides a short reminder of a different statistical concept, runs for just a few minutes, and includes easy-to-follow explanations and examples. As well as the videos, the Stats Tune Up! website features practice questions with solutions and working out, plus downloadable resource sheets that summarise each topic.

"One of the main advantages of Stats Tune Up! is that students don't have to ask for help," said Associate Professor Peter Howley, lead academic on the project. "These resources are available 24/7 to anyone who wants to use them. Students can revisit some of the basic concepts in maths whenever and wherever they like and become independent learners."

A sound knowledge of a range of statistical concepts has often been identified as a major factor in enabling university students to gain access to and succeed in degrees involving health sciences, technology, engineering and maths (STEM). However, many STEM students can do with some help to boost confidence with statistics.

"For some students, statistics can become a roadblock that stops them from continuing with their studies," explained Associate Professor Howley. "Even students who have previously done a lot of statistics might need to review some of the basics. Stats Tune Up! is designed to give students easy access to the help they need to make progress in their studies."

The Stats Tune Up! project was funded through the Commonwealth Government's Higher Education Participation Programme (HEPPP), which aims to improve access to higher education for people who would not otherwise attend university. This includes, for example, people from low SES backgrounds or who may be the first in their family to attend university. Once those students get to university, HEPPP also helps them stay there and successfully complete their degree.

For further information about Stats Tune Up! contact A/Prof Peter Howley on peter.howley@newcastle.edu.au or phone 4921 5518

3. Practice guide

PRACTICE GUIDE: IDEAS FOR USING STATS TUNE UP!

WHAT IS STATS TUNE UP!

A series of animated videos designed to help university students develop their stats skills is now available on the new Stats Tune Up! website created by the University of Newcastle. The videos cover a wide range of statistical concepts that students need to understand in order to stay on top of their studies.

Each video provides a short reminder of a different statistical concept, runs for just a few minutes, and includes easy-to-follow explanations and examples.

What resources are on the website?

As well as the videos, the Stats Tune Up! website features practice questions with solutions and working out, plus downloadable resource sheets that summarise each topic. Stats Tune Up! is designed to give students easy access to the help they need to make progress in their studies.

Q: Where can I find the website?

A: The website can be found at www.statstuneup.com.au

Q: What topics are covered on the website?

A: The videos are categorised into topics designed to tackle threshold concepts of statistical knowledge and skills required in STEM and health sciences fields.

HOW CAN I USE THE RESOURCE WITH MY STUDENTS

In the classroom

The resource can be used in the following ways:

1. Embedded into course material and learning activities: Learners could utilise the videos as a self-diagnostic in order to identify areas for improvement and complete the interactive Practice Questions to gauge improvement. In this way, the apps function as a formative assessment tool. In addition, the website can be accessed via smartboards and projected for instructor demonstration or collaborative learning.
2. Just-in-time learning tools: The website can be used as a learning tool to support mathematical improvement within a cohort, if knowledge gaps have been identified. If gaps are identified as part of the formative and summative assessment within a

course, the instructor can direct students to the site for self-paced numerical improvement.

3. Specialist study skills workshops or academic preparation courses: The website can be included as key learning tools in the academic numeracy component of study skill or academic preparation courses. Instructors can set learners the task of viewing the videos in order to promote self-diagnosis of numerical gaps and reflective self-assessment of improvement.

Out of the classroom

The website was developed to support mobile learning (m-learning). This involves students using the site for independent learning at their own pace, at anytime and anywhere. The website can be promoted as an m-learning tool as part of resources in a course, degree program or learning development unit.

ACKNOWLEDGEMENTS

The Stats Tune Up! project was funded through the Commonwealth Government’s Higher Education Participation Program (HEPPP), which aims to improve access to higher education for people who would not otherwise attend university. This includes, for example, people from low SES backgrounds or who may be the first in their family to attend university. Once those students get to university, HEPPP also helps them stay there and successfully complete their degree.

References

Southgate, E. & Smith, S. P. (2016). Practice guide: Ideas for using Apostrophe Power and Sentence Hero. DICE Report Series, Number 2. Newcastle: DICE Research. Retrieved from [http:// dice.newcastle.edu.au/DRS_2_2016.pdf](http://dice.newcastle.edu.au/DRS_2_2016.pdf)

For further information about Stats Tune Up! contact A/Prof Peter Howley on peter.howley@newcastle.edu.au or phone 4921 5518

4. Dissemination tracking table

MONTH	OPPORTUNITY	ESTIMATED REACH
22 February (dependant on project completion)	UoN Workshop and site launch	<ul style="list-style-type: none"> • 50 face-to-face • 200 hits on website
22 February	O’Week Shortland Union	<ul style="list-style-type: none"> • 500 (postcards & face-to-face) • 300 hits on website
February – March	NSW DEC Newsletters	<ul style="list-style-type: none"> • 49,000 FTE teaching staff have access • 490 hits on website
February – March	University recruitment drive	<ul style="list-style-type: none"> • 50 program convenors contacted • 50 hits on website from mailout/face- to-face meetings
6 March (ongoing throughout March and April)	Stats Tune Up National Poster Competition campaign commences	<ul style="list-style-type: none"> • 9,300 schools contacted • 1500 participants in competition • 200 website hits

MONTH	OPPORTUNITY	ESTIMATED REACH
March	University and TAFE student and staff recruitment drive	<ul style="list-style-type: none"> • 4,500 students reached via email 50 attended sessions • 200 website hits
15 March	NSW PPA meeting	<ul style="list-style-type: none"> • 5,000 primary schools receive minutes • 200 website hits
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12 September	Primary Principals National Conference	<ul style="list-style-type: none"> • 4800 invited • 200 website hits
September (TBC)	UoN Ourimbah	<ul style="list-style-type: none"> • 20 attendees • 20 website hits
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Ongoing	ABC radio national segment on statistical anxiety	<ul style="list-style-type: none"> • 1 radio segment • 8,000 audience reach
Ongoing	PASS sessions	<ul style="list-style-type: none"> • 10 sessions held

APPENDIX C: Stats Tune Up! Random Variables

Before You Watch

Has anyone ever said to you that something is wicked or sick, meaning it is awesome or great? In chemistry a solution may refer to a liquid mixture, whilst in mathematics a solution may refer to the value which solves an equation or a means of solving a mathematical problem. Ever heard of business terms like hedging or leverage? Engineers may use the word gauge to refer to the width of something (e.g., thickness of sheet metal, or diameter of a screw), whilst scientists may use it to refer to the instrument that measures content (e.g., a rain gauge). Every field has its jargon.

Learning Statistics involves learning the meaning of many new terms AND most importantly learning the correct statistical meanings of a lot of familiar terms.

While one term can be broad and interchangeable, another can be very specific and therefore it may be hard to find correct substitute language or terms.

So look for the keywords and terms. Perhaps start your own glossary so you may more easily check word meanings should you ever get stuck.

The Video Content

What are you interested in measuring? Is it an individual's Blood Glucose Level? Or perhaps their temperature throughout the day? Perhaps you're interested in the tensile strength of cables made from a certain steel composite? Or even the reaction time of chemicals?

Whatever the measure of interest, it is referred to as being a random variable, as it may assume any number of possible values, or responses, (usually within some range). It is a characteristic of the individual, or item, or subject, we are studying.

The value, or response, for the random variable, or, 'characteristic of interest', will vary depending upon the individual or item we happen to be observing, or the point in time at which we do so. The specific values that we observe for a variable are known as data.

Knowing a variable's TYPE is important as it determines which analyses, or methods of reporting or displaying the data, are appropriate to apply.

The first step is to determine whether the variable is CATEGORICAL or NUMERICAL.

Do the responses to the variable fall into categories? For example, if measuring 'Sex' of each person, the possible responses are either 'Male' or 'Female' ... each person falls into one of those two categories. Hence the variable, or 'measure of interest' or 'characteristic' 'Sex' is a categorical variable.

What about when the possible responses are numbers which reflect the quantity, or amount, of something? For example if measuring 'Blood glucose level' of each person, the value we observe is the quantity of glucose in the blood, usually measured in millimoles per Litre. So the variable 'Blood glucose level' is a numerical variable.

The Second step further identifies Categorical variables as either Nominal or Ordinal, and Numerical Variables as either Discrete or Continuous.

If the categorical variable's responses have no natural order to them, then it is called a nominal variable. For example, for the variable 'Sex' the possible responses are Male and Female, and there is no reason why Male should be listed before Female nor vice versa, there is NO natural order. So 'Sex' is a nominal variable.

If the categorical variable's responses have a natural order, then it is called an ordinal variable. For example 'Risk of developing coeliac disease'. If the possible responses are 'Low', 'Medium', or 'High' then we can see the categories have a natural order, Low comes before Medium, which comes before High on the scale of Low through to High.

If the numerical variable's possible responses are numbers arising from a measuring process and can assume only certain or distinct values, then it is called a discrete variable. For example, consider the variable 'Daily number of adverse events' which measures the number of undesirable outcomes occurring in a hospital ward each day. We can observe either 0, or 1, or 2, or 3, and so on events. But we cannot observe 1.35 events- it must be a whole number. This is an example of a discrete variable (it can only assume certain values).

If the numerical variable's possible responses are numbers arising from a measuring process and can assume ANY value within some range or along some continuum, then it is called a continuous variable. For example, Blood Glucose Level. We can record the result as precisely as the measuring device or instrument allows, we could observe values like 5.54 millimoles per Litre or even to more decimal places depending on the measuring instrument. NOTE: it is not the measuring instrument that determines whether a variable is discrete or continuous. The fact that Blood Glucose Level could be measured to be any value within some range is what determines that the variable Blood Glucose Level is continuous.

When we record data for variables, we consider each individual as a record - this is presented as a row in a data table. Then we would record the data for each variable in columns.

So if Person 1 was Male and had a Blood Glucose Level of 5.45 and we recorded similar values for each person, then we see the datatable build.

So, you've now learnt about the four variable types and are getting some data...so it's time to build upon this and see how we might present data arising from each of these variable types...you can learn more about this in the next video in this series.

Now What?

This video is designed to give you an introduction to the concept of a random variable and how to determine a variable's type. You are now ready to look at how we may turn the data for a given variable into readily interpretable information (see the videos Visual Displays - Single Variable , and then Visual Displays - Two Variables).

But, when am I going to use this?

Statistics is essential in all fields of study - it provides a deeper understanding and credibility of investigations within the field. Variation is all around us, Statistics helps us quantify and

learn from this variation. Statistics is fundamental to the design and analysis of experiments or investigations, for example, medical trials.... It's also used in quality control...

Other Links

A YouTube video made by the Statistics Learning Centre in NZ gives an overview of data types using animation that is easy to understand and fun. Note that numerical data types has been given alternative names. Interval and ratio data are used instead of discrete and continuous. It is a slightly different approach but the same principle.

<https://www.youtube.com/watch?v=hZxznfnt5v8>

If you really want to understand types of data, along with appropriate statistics and graphs, you can learn on our new Snack-size course. Takes about an hour, and lots of fun!

<http://www.statslc.com/snack/>