USING WEB APPS IN THE CLASSROOM STYLE

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Web Apps in statistics/ official statistics were first mooted at ICOTS9. Two New Zealand academics, an IT support person, the director and web-master from the UK Royal Statistical Society Centre for Statistical Education together created three apps: Measuring Price Change, Comparing Populations and Graph It In Excel. They are sited on the Resources Page of the International Statistical Literacy Project website, freely available for use by individuals or in the classroom and contain information about the subject including videos, interactive visualisations, links to other websites and structured examples designed for self-teaching. Teachers' and students' perceptions of the apps in three different teaching environments in New Zealand are given: a two-day course for policy analysts, an across-university statistics honours course and a third year sociology course.

INTRODUCTION

In 2013 a joint project involving Neville Davies, the director of the United Kingdom Royal Statistical Society Centre for Statistical Education (SSCSE), and two New Zealand academics, Sharleen Forbes (then Adjunct Professor of Official Statistics at Victoria University in Wellington - VUW) and John Harraway from the University of Otago in Dunedin (OU) was initiated to investigate the feasibility of producing e-learning tools such as Apps covering material contained in the New Zealand Certificate of Official Statistics (Forbes and Keegan, 2016). This competency based Certificate has been taught in both New Zealand and the Pacific Islands since 2007, consists of a set of basic statistics and official statistics modules and is aimed in particular at government managers and advisers.

The idea of producing Web apps in official statistics was discussed at ICOTS9 in Arizona in 2014, where it was decided that the resulting e-learning tools should be:
- free and easily accessible
- self-contained on a variety of IT platforms such as desktop computers, laptops, tablets and Smart Phones
- have an international perspective encouraging use in developing countries
- interactive, making them less like static e-books and more like a miniature learning environment including questions, quizzes, etc.
- based on a structured learning approach (Forbes et al, 2014).

A working group comprising Neville Davies, Dominic Martignetti and Kate Richards from the SSCSE, Sharleen Forbes (VUW), John Harraway and Greg Trounson (OU) prioritised the learning needs of government policy advisers then developed the following three Web Apps:
1. *Measuring Price Change* – which has a focus on the Consumer Price Index (CPI), working with price indices, changing base year, time series in connection with the CPI, moving averages, trends, seasonality, and policy uses.
2. *Comparing populations* (over time between countries and between groups within countries) - includes demographic techniques, fertility, mortality, migration, life tables, population pyramids, age standardisation and odds ratios.
3. *Graph It in Excel* – includes a history of graphics, good (and bad) data presentation and gives instructions for the creation of simple graphs including boxplots and population pyramids.

The Web apps were demonstrated at the International Association of Official Statistics (IAOS) conference in Da Nang, Vietnam in 2014 and the World Statistics Conference in Rio de Janeiro, Brazil in 2015. They are currently hosted on the International Statistical Literacy Project (ISLP) resources page of the IASE website,

Measuring Price Change: http://iase-web.org/islp/apps/gov_stats_priceindices
Comparing populations: http://iase-web.org/islp/apps/gov_stats_populations
Graph It in Excel: http://iase-web.org/islp/apps/gov_stats_graphing.

It was initially envisaged that the web apps would be used for self-teaching by individuals but they are also suitable for use in classroom environments with access to suitable technology. In New Zealand, the web apps have been used in several different types of university courses. In May 2017 they were used by Dr Sharleen Forbes within the classroom in a 2-day VUW Continuing Education course (Evidence-based Decision Making) for local and national policy advisors that had nine participants. An Honours course in official statistics delivered through a multi-media link between five New Zealand universities (Forbes and Harraway, 2012) used the web apps to complete an assignment. In 2016 and 2017, John Harraway and Bryndl Hohmann-Marriott (a senior lecturer in Sociology at the University of Otago) were involved in the course, which enrols between 30-60 students, mostly from Statistics programmes. Both the policy and Honours courses covered a range of official statistics topics including demography and price indices. Bryndl Hohmann-Marriott also used the web apps in demography assignments over the past two years in a 300-level Family Demography course that has approximately 40 students each year mainly from Sociology and other social science majors.

METHODOLOGY

Monthly usage of the web apps can be determined by the number of unique visits to the website. Information about numbers of App usage before October 2017 is not available but monthly usage from October 2017 onwards will be recorded. Students in both the 2017 Official Statistics and VUW policy courses were invited to participate in a short Survey Monkey questionnaire (see Appendix) about their experiences using the web apps. The questions asked were: occupation, which web apps had been accessed, the types of device used to access the web app, how easy it was to follow, how much support was needed to use the web app, the aspects that were helpful, whether it's use would be recommended to others and what aspects would you like more (or less) of, possible additions and other topics that web Apps could be developed for. Written feedback was also obtained directly from the course teachers.

WEBSITE VISITS

In the month of October 2017 the "Measuring Price Change" web app had 26 visits from unique IP addresses, "Comparing Populations", had no visits and "Graph It in Excel", had 1,237 visits. However only 159 of these involved visits to the actual website. The remainder, 1,078, were direct downloads of one or more of the accompanying PDF documents. One document, "GoodBadGraphs.pdf", was downloaded 2,204 times, from 804 unique IP addresses (probably the result of searching "good and bad graphs" in Google). There is no single biggest source of hits, with visits from the UK, Australia, US, Hong Kong, South Africa, Canada and the Netherlands.

Links to the three web apps were given in the HANDOUTS AND RESOURCES section of the web page for the Official Statistics Honours course and students would have been completing their assignment on Price Indices in the month of October, so it is possible that some of the "Measuring Price Change" visits were from these students.

FEEDBACK FROM STUDENTS

Evidence-based Decision Making Course

The nine participants in this course each used their own personal device in class. Both written content and exercises from the Measuring Price Change and Comparing Populations web apps were used in the classroom and the Graph It in Excel web app was given as a reference tool for use when students needed to create their own graphs.

Seven of the nine participants responded to the SurveyMonkey questionnaire sent to them after the course. As expected, six of the seven (one didn't respond) described their occupation as some form of policy analyst. All seven had accessed the two web apps used in class and one had also accessed Graph It in Excel. Six accessed the web apps on a laptop and one on an iPad. Two students reported that the web apps were very easy to use, four that they were reasonably easy and one that they were slightly difficult to use. The amount of support needed was related to the ease of use with four saying that they needed no support, two that they needed some and one a lot of support. The following aspects of the web apps were found useful (number of students in brackets):

Worked examples	7
Structured exercises with answers	6
Documentation about the topics	4
Video material	2
References and links to other websites	1

All the students stated that they would recommend the web apps to others. There was only one suggestion for the final three questions (aspects they'd like more (or less) of, possible additions and other topics) that there be a '*Bit more plain English explanation of the maths processes*'.

Official Statistics Honours Course

In this course, the Graph It in Excel web app was used in an assignment in the Demography module. This assignment included the creation of a population pyramid using Statistics New Zealand data. Students were given instructions to access the Create Your Own Graph in Excel section of the web app, "Scroll down to Population Pyramids (#4); read the Introduction, watch the Video, and use the Instructions (under Documents) to complete your pyramid."

When invited to participate in the survey, 13 students (20%) participated. Respondents gave their field of study as Data Science (6), Statistics (5), Applied Mathematics (1), and Analytics (1). All of them found the Web Apps either very easy or somewhat easy to use; none indicated that they were difficult. Nearly all respondents (11) reported needing no support to use the Web Apps; the two who required support also reported having no familiarity with Excel or other spreadsheet applications. Aspects of the Web Apps students found helpful included:

Worked examples	11
Video material	10
Documentation	5
Structured exercises	4
References and links	3

One student commented: "The goal of the apps is commendable. Please focus more on response speed, and a helpful GUI [Graphical User Interface]."

Third Year Demography Course

This course included structured computer labs in which students completed essential demographic graphs using UN data, including population growth, fertility, life expectancy and population pyramids. From 2010 to 2015, the assignment offered step-by-step instructions for constructing population pyramids in Excel. Students required a great deal of assistance during their computer lab with many experiencing frustration and confusion, and the resulting graphs often contained formatting errors. In 2016 and 2017, the assignment directed students to the Graph It in Excel web app with students given similar instructions to those in the Official Statistics Honours course (same lecturer in both). The assignment gave the link, then instructed: "On the Population Pyramids page, read the Introduction, watch the video, and open the Instructions document." Students required much less assistance in the lab, there was very little frustration or confusion, and the resulting graphs were consistently more accurate.

FEEDBACK FROM TEACHERS

Evidence-based Decision Making Course

The teacher experienced no issues with 10 people simultaneously accessing the web apps in the classroom, and little demand for teacher interaction with more technologically able students actively helping others. Students also seemed to enjoy the change from more traditional chalk and talk and other workshop activities with several reporting that the continued 'playing' with them in their own time. One unexpected benefit was that the structured learning examples reduced the time spent on the understanding price indices topic.

Official Statistics Honours and Demography Courses

In these courses, students used the Graph It in Excel web app to complete an assignment in their own time. The teacher reported that none of the Official Statistics Honours students had questions about completing the population pyramid, and most students received high marks for their resulting graph. In the Demography course the use of the web app reduced student confusion and frustration and resulted in more accurate graphs being produced.

CONCLUSION

The three web apps discussed above provide teachers with a new media and form of instruction in the classroom. They were used in different ways in these three courses, in the Evidence-based Decision Making course as both an electronic reference book and a source of exercises for students to attempt in the classroom and in the other two courses as a tool for students to use when completing an assignment. Regardless of how the web apps were used, both students and teachers reported that the web apps were easy to access with no technological problems (including on different devices such as laptops or tablets and for multiple simultaneous access). In addition, students enjoyed working with them and they seemed to enhance student understanding and ability to use data.

These web apps are free for anyone to use and have been shown to be useful for both individual students and in group classroom activities.

REFERENCES

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APPENDIX

SURVEYMONKEY QUESTIONS (Response options given in brackets):
1. Describe your occupation/field of study
   (Open response)
2. Which of the web apps have you used (select all that apply)?
   (Measuring Price Change, Comparing Populations, Graph It in Excel)
3. What device(s) did you use to access the web apps (select all that apply)?
   (Computer or tablet, iPad or other tablet, mobile phone)
4. How easy did you find the web apps to follow:
   (Very easy, Reasonably easy, Slightly difficult, Very difficult)
5. How much support did you need to use the web apps?
   (Easy to use by myself, Some support needed, Needed a lot of support)
6. Which aspects of the web apps did you find helpful (select all that apply)?
   (Documentation about the topics, Worked examples, Structured exercises, Video material, References and links to other websites)
7. Would you recommend the web apps to others?
   (Yes, No)
8. Are there any aspects of the current web apps that you would like to see more or less of?
   (Open response)
9. Are there any additions that you would like to see?
   (Open response)
10. List any other topics that you would like to see web apps developed for?
    (Open response)