Stepping into Statistics: Providing a Head Start for students

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Abstract

The major aim of this paper is to discuss the learning design of a head start introductory statistics module made available to students on-line. It explores the combination of different kinds of resources in particular genres of video to support learning and the learning of discipline content and processes. Different mechanisms for facilitating communication between students, and production issues and issues in merging the head start program with the introductory statistics subject.

Introduction

For the past 15 years the development of an introductory first year level university statistics subject, STAT has been guided by a quality cycle of planning, acting, reviewing and improving. Each year students valuing of resources has been evaluated in terms of their usefulness in helping students learn and understand statistics. Resources that have not been considered valuable terms of helping students learn have been reworked or replaced. For some years students have placed a high value on their laboratory manual, lectures, assessment, provision of marking criteria and fully worked solutions. Innovations have included the collection and use of real data and working topics of social significance. Students have since the 1990s have been provided with access to all resources and communication with other students on line through an E-Learning system.

The subject fits a traditional subject teaching profile in that it provides three weekly lectures (numbers 80-300 students) and two hours in a laboratory class (numbers 20-30 students). In this subject lectures are highly interactive even with large class sizes. New topics are started with an activity to elicit student ideas and these are then refined and formalized in terms of the appropriate statistical language and theory. Students work with a mix of real data gathered by them selves and data supplied by others. Strategies for learning and learning issues that arise are also explored. In recent years there has been an increasing numbers of students using online resources rather than face-to-face. In 2010 students with no previous failures were allowed to complete their laboratory work at home or in their own time. Only the lecturer of the subject is avaible outside of class time to assist students.

In the search for the best approach a variety of assessment tasks have been employed over the years. These have included assignments involving the collection and analysis of data, portfolios, summaries, tests and presentations to class and final examinations. Different weightings have been applied. The approach that has been adopted involves a final examination worth 50 per cent, a presentation where the student in a pair collects their own data and makes a presentation to class worth 10 per cent and four competency "tests" commencing in even weeks from the fourth week of a thirteen week session. Typically only the first of these tests is held within the class and the remainder completed by the students in their own time. The "tests" involve analysing data and working with theory, like an assignment but the allowed time is a few days. The first tests have a rapid turn around in terms of marking and students are provided with fully worked solutions. In odd weeks the students who do not gain 70 per cent are required to undertake a similar test, and those not passing the second test are identified as "at risk" students. The "at risk" students are given more support through directing them to resources, interviewing the student, or direct comments on the work. In the final week, make-up tests are available to all students.

In 2009 the online resources were expanded to include a variety of video clips relating to different topics. Early approaches to providing resources to students included grouping all similar resources for example lectures, video clips and data.

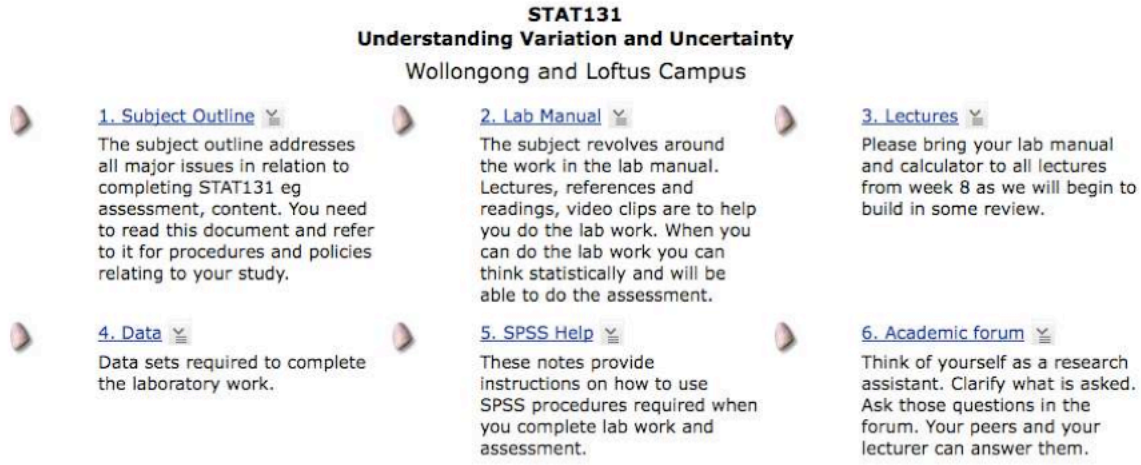


Figure 1. Organisation of resources for students by common category

An alternative approach has been to Group resources by week as in Figure 2.

Figure 2. Organisation of resources by week.

A third option has been to group both by category of resources and by week.

Student change evaluations revealed that when the students used the video clips they were considered extremely useful in helping students learn and understand statistics. However not all students *found* the video clips. As a consequence in 2010 the innovation focus was on the learning design itself. In this introductory subject students were provided with a *learning design visual sequence* illustrating the "chronology of tasks, resources and supports" (Aghostinho et al, 2009). Originally conceived of as a learning design from the perspective of the teacher, in this subject it was used to communicate with the students, the tasks they had to complete, the primary resources and support materials if they needed additional resources, see for example Figure 3.

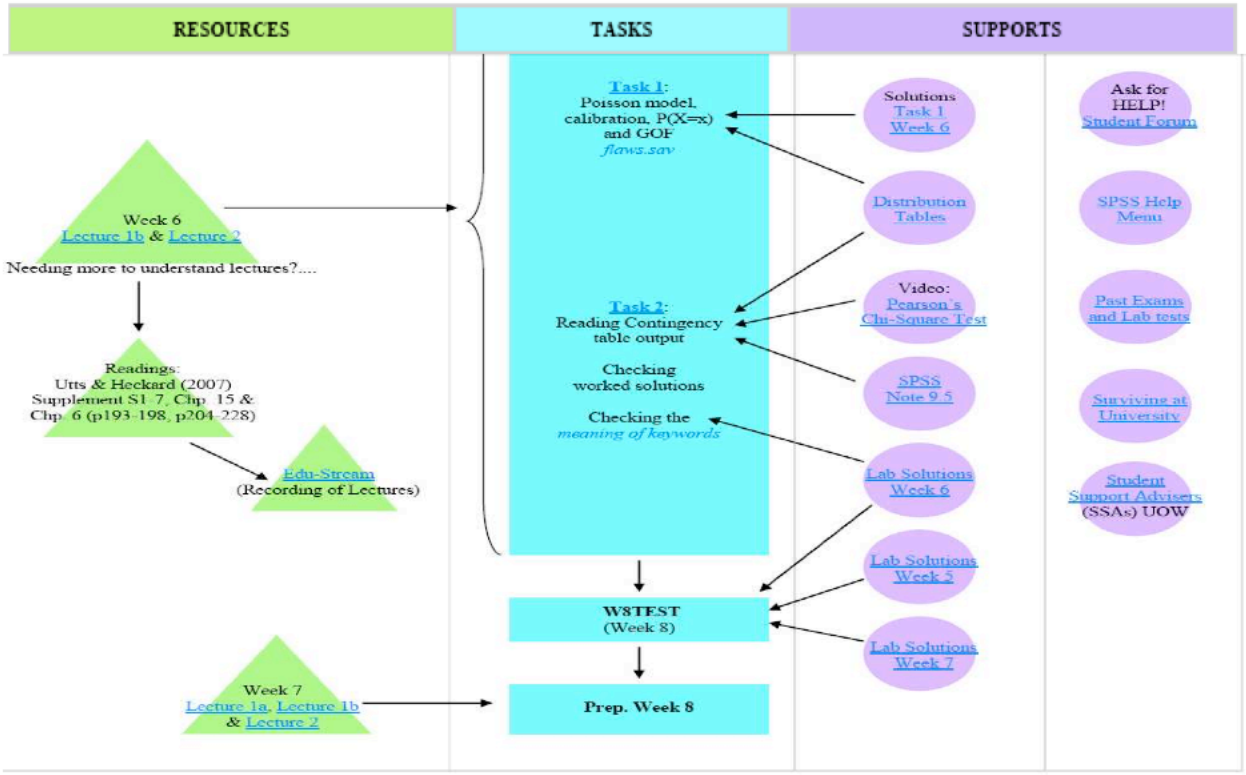


Figure 3. An extract of a learning design visual sequence for a week of STAT (Porter & Baharun, 2010)

The visual learning design maps linked all student supports, resources and tasks. The competency based assessment system allowed early identification of students at risk, that is those who did not satisfactorily complete any test/re-test sequence. Video clips were used to provide students with discipline support and this was supplemented by direct communication, both email and in-person, between the lecturer and at risk students. The map provided a clear picture of what was required, when and what help was available.

One outcome of trying new approaches is that as a teacher one can see what was previously not evident. It makes no sense that students would enroll in a subject, pay fees and walk away with a zero, low mark and a fail grade. There are students who are inactive, do not come to class and do not submit assignments that feasibly deserve such a grade. For some years there has been an increase in zero/low mark fails typically interpreted as students who cease to be active in the subject but who do not withdraw. How to engage these students has inspired innovations in the statistics subject for the past fifteen years. As teachers we have worked with the mantra "If we can get students to class we can assist them through the learning." At a graduate level the innovations with on-campus, distance and international students have been highly successful with many learning outcomes including a low failure rate (Baharun & Porter, 2009). At the undergraduate level the learning design map teamed with competency-based assessment highlighted another group of students, seemingly with learning difficulties, namely students who attend lectures and laboratory classes, are active in class answering questions, but who have difficulties submitting assessment even after guidance and with the possibility of re-submission.

Non-submission of assessment is the key indicator of pending student failure. For this group of students being able to communicate what they know through the assessment system appeared problematic. However, at the end of session students with the exception of one, unanimously endorsed the assessment system. Contrasting with this, approximately two-thirds of completing

students indicated that they would like access to a head start program. Students wanted more time to cover the curricula. Hence, the development of a Head Start module.

Head-Start Module

The Head-Start module implements a draft-final assignment model rather than the test-retest model of STAT, potentially a more positive experience than "failure" feedback repeat test. This should assist more fragile learners. The module is accessed on-line after students have enrolled in the subject. For students electing to complete the module, they will have approximately three weeks head start and will be able to complete a first piece of assessment which can substitute for the first in-class test in the subject proper. The first two weeks of session then become consolidation of the Head Start program (See Figure 4.)

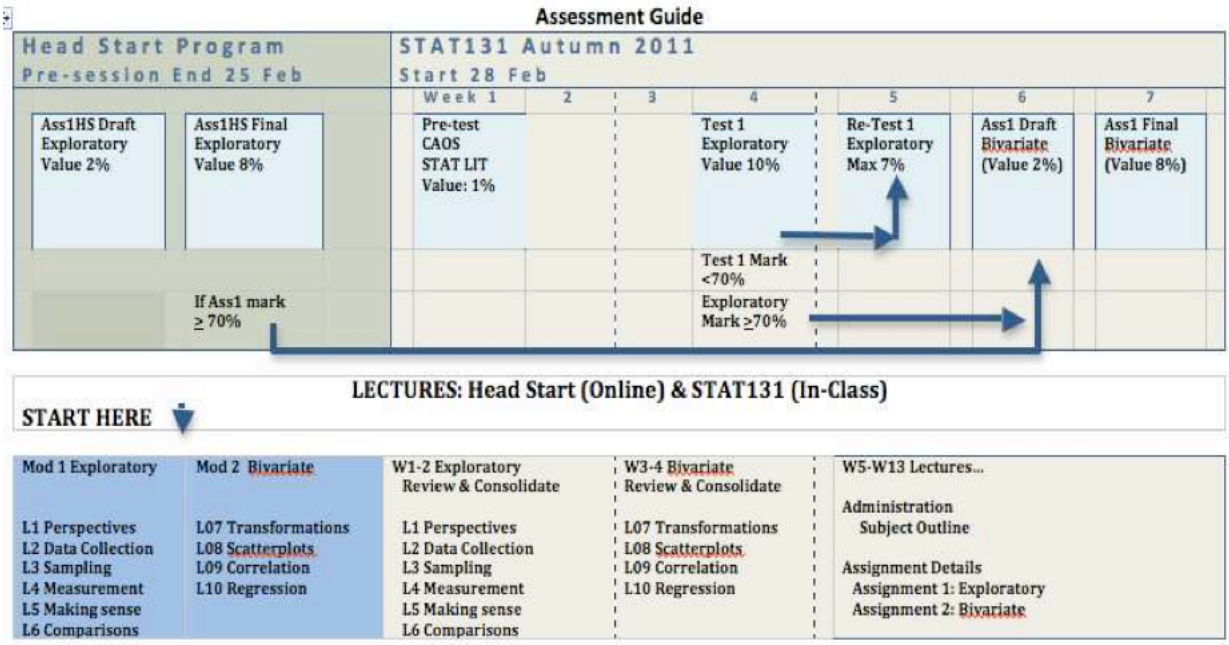


Figure 4. Merging the head-start module and STAT subject

From the outset a pattern is established for the Head Start on-line lectures.

1) Orientate the learner with text and video

Orientation: *In 2010 approximately two thirds of the students completing STAT131 indicated that they would like to be able to commence STAT131 before the official start to classes. They felt too rushed to take on board the new skills. The Head Start Program Stepping into Statistics allows students to …*

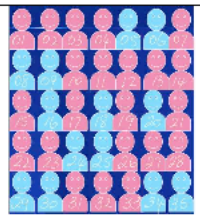
2) Provide an activity to get students communicating with each other

Task 1 Meeting colleagues and identifying your pre-conceptions about Statistics
Introduce yourself to other students in the academic forum.
Without looking at any text or what other students say write down:
What you think statistics involves?
Do you have any concerns about studying statistics?
What you are looking forward to in studying statistics?
See what others have to say.
Review your answers at the end of session.

3) Provide an activity to address a relevant learning issue

Task 2 Experience the rush Many students find complex, multistep math problems particularly difficult. The problem set on the next page is designed to evoke in you the feelings a student might feel working out a problem that requires combining and using several mathematics skills in a short period of time. Give yourself **two minutes** to solve all three problems. **Adapted from** http://www.pbs.org/wgbh/misunderstoodminds/math.html	Follow all four instructions below to solve each of the three problems. Record your answers. A. Multiply the third number in the first row by the seventh number in the third row. B. Add this result to the fifth number in the second row. C. Add to this total ten times the fourth number in the third row. D. Subtract the eighth number in the first row from the result. Problem 1: 6 5 8 7 4 5 6 8 4 3 2 1 9 5 6 4 2 1 6 5 1 5 1 3 2 3 5 etc Debrief

4) Provide a sequence of tasks for the students to complete that cause them to interact with the discipline issues, content and processes.

Task 3: Not comfortable accepting statistical results Many people are uncomfortable when research outcomes are based on a **sample** or portion of the entire **population** for which data on some **variable** are collected. The video clip has an exercise where you conduct a census. Do this and answer the following: Why it is often acceptable and maybe even better to collect data using a sample rather than a census?	
Task 4: Simple Random Sample For a sample to represent the population you must use a probability sampling plan. Here we have a population of 35 men and women, they represent your sampling frame. Your task is to take a simple random sample of size 7 using a random numbers table. What observations are in your sample? How did you get them?	 Population of 35 Random Numbers Table

Conclusions

At this stage evaluation remains at the design level. From the perspective of Boud and Prosser (2001) to have the potential for high quality learning the design must address engagement of learners, consider the implementation within the broader learning context, challenge learners seeking active participation supporting students ampliative skills and provide practice. The Head Start module relies heavily on a variety of resources combined with different types of activities to connect students with their discipline and everyday life decision-making. The video resources include orientation chats, worked examples to demonstrate calculations, theory snippets, stimulus materials, procedural matters such as taking a sample (Task 4) or using statistical packages and interpreting output . The opening forum communication, Task 1, sets the scene for students to begin to explore their perspective as to what statistics involves and this is followed by activities that challenge narrow definitions of what statistics is about. Activities such as those in Task 3 where students conduct a census and discover that they have probably not "counted" correctly and that maybe sampling is a good approach to collecting data are to engage students, through providing an activity that challenges their perceptions. Throughout the module students are provided with practice, working with data and theory and debriefing through video clips.

Students have only just commenced the head start module and further evaluation will be required to explore whether the uptake of the program and the benefits to students has warranted its development.

References

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