

DEVELOPING AND PRESENTING CONCEPTUAL MAPS OF COURSE CONTENT

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Teaching online involves providing an environment that is interactive and engaging. A large part of this is providing suitable learning resources. In this talk we will demonstrate an efficient method for producing conceptual maps of the actual course content, showing the structure of the subject for students in a visual way. The structures that result allows for learning resources to be linked in as required. The maps are developed using PowerPoint but they can be deployed in a web-friendly format or on CD-ROM.

WHAT IS A CONCEPT MAP?

A concept maps is a graphical way of organising knowledge. There are many different forms, but all have in common that concepts or themes or ideas are identified and then related concepts are linked together. Often concepts are drawn as ovals or rectangles, containing a brief description or definition of the concept, and lines are drawn to related concepts to form a network. Concept maps are also sometimes called mind-maps or graphical organisers, though mind maps and graphical organisers usually are limited to hierarchal structures while more general concept maps allow more complicated linkages. In some maps the lines connecting concepts (the links) are sometimes labelled to convey the nature of the relationship between the concepts. Outlining or a standard table of contents in a book are similar non-graphical ways of organising knowledge. The menu structure in software packages also presents another non-graphical way of organising knowledge.

Concept maps are commonly used for purposes such as brainstorming, note taking and as a way of organising and managing knowledge in organisations (Cañas *et al.*, 2003). They also widely used for supporting teaching and learning. For example, teachers often find it valuable to create a concept map for units they teach. Doing so requires the teacher to clearly identify the key concepts they wish to emphasise and therefore helps in preparing lesson plans.

The use of concept maps in learning and teaching stems from the assimilation theory (new knowledge is assimilated into existing cognitive structures) of David Ausubel (Ausubel, 1968). Joseph Novak and others carried out much research on the use of concept maps in teaching science (Novak and Gowan, 1984; Novak and Musonda, 1991). Harnisch *et al.* (1994) identified three ways that concept maps support teaching and learning:

- for instructional planning
- for learning
- for assessment.

Based on this, Schau and Mattern (1997) presented examples and findings on the use of concept maps and graphic organisers to support the teaching of introductory statistics courses.

In this paper we discuss some limitations of traditional concept maps and present an alternative version/style implemented using Microsoft *PowerPoint* that may be more suitable for delivery online or on a computer.

DRAWING CONCEPT MAPS BY EMBEDDING CONCEPTS WITHIN CONCEPTS (USING POWERPOINT)

As mentioned previously, concepts maps are usually drawn as a network, with the nodes/concepts represented as rectangles or ovals (containing a brief description or definition) linked by (possibly labelled) lines that represent relationships between the concepts. Drawn in this traditional way it is possible to conveniently view only a limited number, up to maybe 50 or so, concepts on a page or computer screen, and even then some of the rectangles or ovals for concepts can become quite small and difficult to read. However, one of the important features of a concept map is that they show the overall structure of knowledge and indicate where there is

‘depth’ that can be investigated. So the physical space requirements can limit the usefulness of concept maps.

There are a number of techniques for overcoming the physical space limitations. For example, it is possible to break concept maps into separate smaller maps that each deal with a particular segment, like the chapters in a book. These can be linked into a ‘master’ map to give a view of a whole course. Another method is to use hyperlinked words, as on a normal web page, which takes up less physical space. We propose another method for possibly overcoming this limitation.

The idea is to have images of that part of the concept map that is linked to a particular concept embedded and visible within the concept itself. Then ‘depth’ can then be seen by looking down into the concept itself. We illustrate using maps developed in *PowerPoint*.

The image in Figure 1 is the concept map presented by Schau and Mattern (1997, Figure 1).

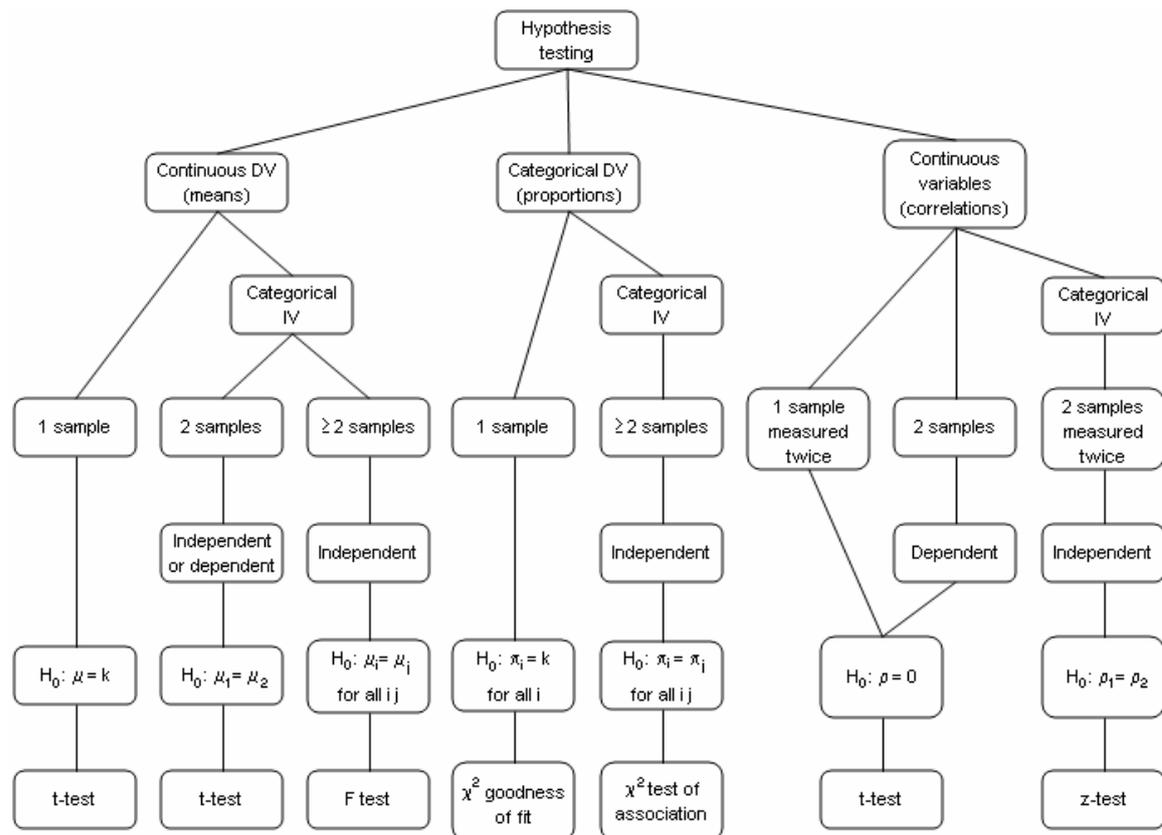


Figure 1: A concept map used by Schau and Mattern

The same map using the ‘embedded concept’ idea drawn using *PowerPoint* is presented in Figure 2.

The idea in this *PowerPoint* version of the map is that individual slides correspond to concepts, and images of slides corresponding to linked concepts appear on the slides themselves. Of course, the *PowerPoint* slides are viewed one at a time, not a number at once as in Figure 2, and while not all the detail can be seen in any slide, the user can see where there is detail and depth, and they can ‘drill down’ to find the information. When viewed on a computer, this ‘drilling down’ to lower level concepts is achieved by clicking on the image of a child slide to expand the child slide. For example, if a user is viewing the first slide in Figure 2 (Hypothesis Testing), clicking on the image of the ‘Continuous Dependent Variable’ slide then displays that second slide ‘full screen.’

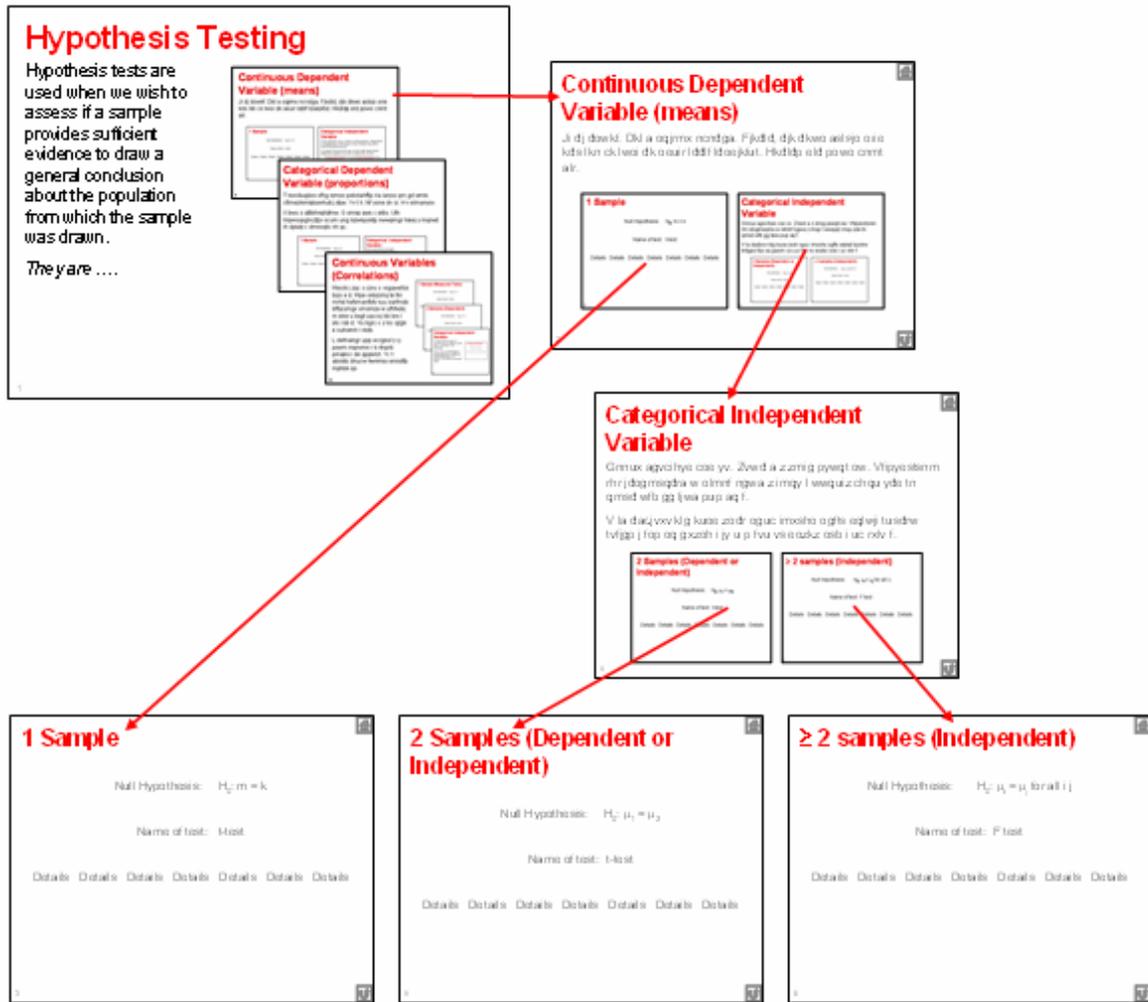


Figure 2: A PowerPoint version of the concept map in Figure 1

The PowerPoint versions of concept maps drawn in this way can include other features:

- Because concepts have a whole slide to themselves, it is possible to add information to describe and explain the concept. The slides pictured in Figure 2 illustrate the idea.
- Features to assist in navigation can be provided on the slides. For example, in Figure 2, a home button has been added in the top right of each slide and a return button to go up to the parent of the current slide has been added in the lower right.
- The maps are extendible by simply adding new slides and creating new hyperlinks where needed. The new slides can either correspond to new concepts added at a high level, or can add additional detail by going deeper.
- Because concepts appear as images on other slides, the developer can physically arrange the images to show relationships or other structures. For example, it is quite common for concept maps to be used to implement flow charts. In that case the images of the slides corresponding to the steps in the sequence of decisions and actions can be arranged just as in a printed flow chart. Example 4 below shows the idea.
- Hyperlinks can be added to other resources such as files or web pages external to the PowerPoint presentation. For example, it may be useful to include hyperlinks to demonstrations or to Word documents that explain the concepts further. See Example 5 below.

Concept maps drawn using PowerPoint in the way described above, including the creation of the images and the hyperlinks between the images of slides, is quite straightforward

and uses standard *PowerPoint* functions. However, it can be tedious work. It can also be tedious to provide additional features such as the navigation buttons. Another issue that arises is that changes made to lower level slides mean that the image of that slide on its parent must be updated. A tool is available to assist the instructor in making these ‘roadmaps’: RoadmapTools.pps, available from www.deakin.edu.au/~rodneyc/ConceptMappingICOTS.html.

EXAMPLES OF CONCEPT MAPS DRAWN USING POWERPOINT

The images in the examples shown below do not capture the full effect of concept maps drawn using *PowerPoint*, and the reader may wish download and use the actual *PowerPoint* files from www.deakin.edu.au/~rodneyc/ConceptMappingICOTS.html.

1. A concept map of a traditional introductory business statistics course

The table of contents in any textbook can be easily converted to a concept map drawn using *PowerPoint*. Figure 3 shows such a map constructed from a typical business statistics text.

2. Tools-oriented (based on SPSS menu)

A concept map for a tools-oriented approach to teaching statistics is pictured in Figure 4.

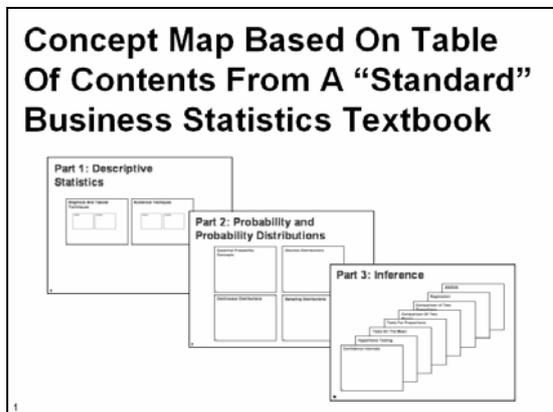


Figure 3: Concept map of a traditional business statistics course

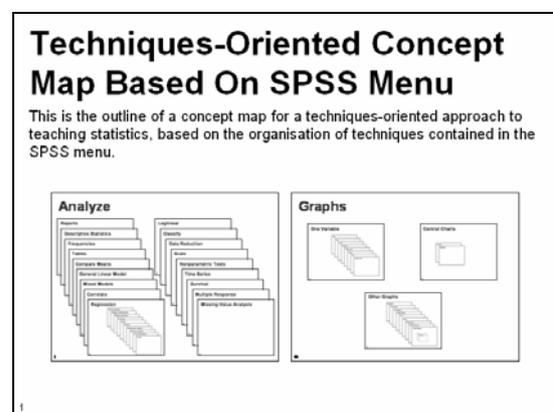


Figure 4: Concept map of a techniques-oriented course

3. SPSS 'Statistics Coach'

The ‘Statistics Coach’ in *SPSS* provides a structure for guiding students through the steps and decision making involved in using *SPSS* for analysis. Figure 5 shows of version of this tool as a concept map created using *PowerPoint*.

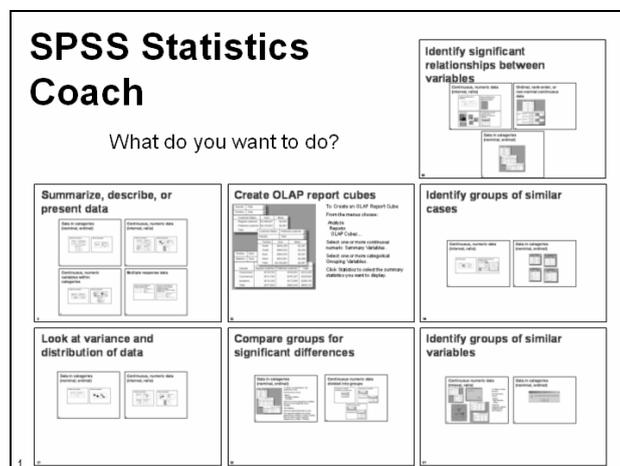


Figure 5: Concept map of the *SPSS* Statistics Coach

4. Flow chart

Concept maps drawn using *PowerPoint* can be used to present flow charts showing the sequence of activities and decisions made in carrying out statistical analyses. Such flow charts are found in many texts. The image in Figure 6 shows a flow chart for decision-making taken from Levine, Berenson and Stephan (1997, Exhibit 14.2). It illustrates a variation on a concept map drawn using *PowerPoint* where, because of size restraints, the images of the sides are not shown, and instead the subconcepts/slides are hyperlinked to via words.

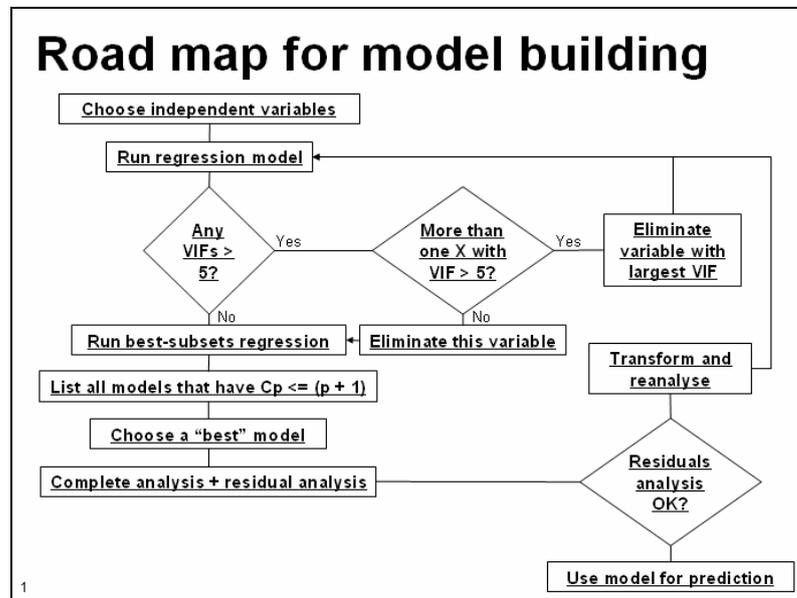


Figure 6: Flow chart

5. Step-by-step with and classification by number and type of variable

The above examples may be expanded to create a complete course. Figure 7 shows one possibility.

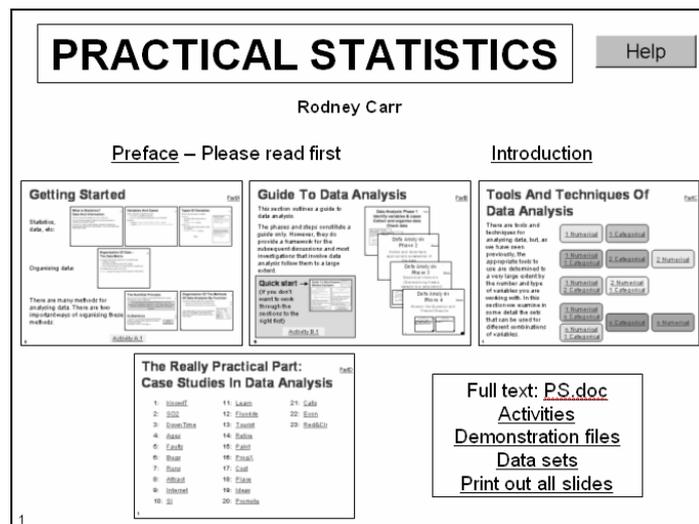


Figure 7: Concept map of a course using a step-by-step approach and classification by number and type of variable

One of the sub-slides taken from this concept map is shown in Figure 8. It illustrates another feature of concepts maps constructed using *PowerPoint* – the ability to hyperlink to external files. On this slide there is a link to an Excel file used for demonstrating a particular idea, and a

hyperlink to a Word document that contains further information, details, exercises, etc, that relate to this concept.

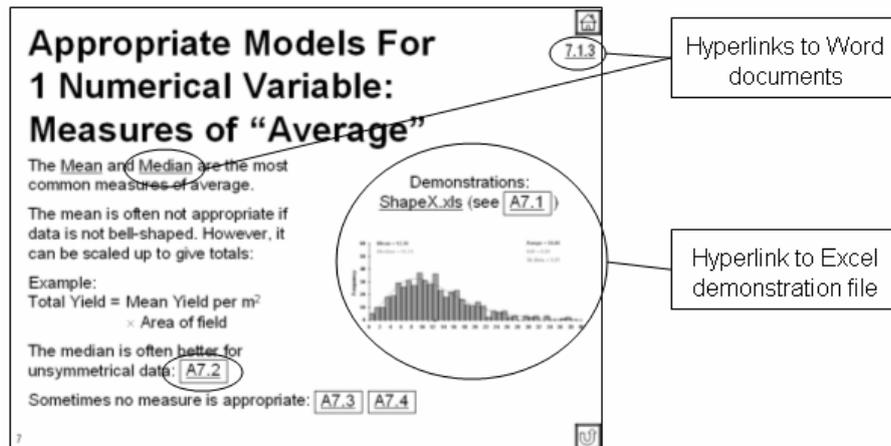


Figure 8: Enriching a concept map by hyperlinking to external resources

Note: Using concept maps for a whole course, and the ability to add richness by linking to additional external resources, illustrates an important feature of concept maps: they can act as ‘containers’ into which other learning resources can be hyperlinked. This may assist teachers working in teams sharing and jointly developing learning resources. The idea is that once a concept map for the overall structure of a course has been created, different members of the development team can contribute learning resources without affecting the overall structure. This may contribute to team building and provides a way for ongoing incremental development.

6. Other possibilities

Many other examples of concept maps are possible, in fact probably one can be created no matter how a course is organised and presented. For example, concept maps for case-study-based courses have been created.

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