

Interactive learning

Concept mapping, PowerPoint, and a pedagogy of access

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This article explores the synergy that can be created when concept-mapping techniques are used in collaboration with the construction of PowerPoint presentations to increase the richness of the learning experience. Some weaknesses of the typical PowerPoint format are highlighted with a description of how they can be overcome through a more considered approach to both the structure of the presentation and the design of supporting handouts that incorporate ideas taken from the literature on concept mapping. In combination, these complementary tools (concept maps and PowerPoint) might contribute to an epistemologically balanced teaching approach. Reflection upon the revealed diversity of students' views may contribute to lecturers' conceptions of teaching. The possibility of using this to generate an inclusive pedagogy of access within higher education is introduced.

Keywords: Affordances; Dialogue; ICT; university teaching.

Introduction

Within the teaching of biology (and related disciplines) in higher education, lectures are now commonly supported by PowerPoint presentations. Whilst there are numerous published accounts that aim to help teachers produce clearer, more professional looking slide presentations, there are few publications regarding the pedagogical implications of an increasing teacher-dependency on presentation software. Many lecturers see the production of a PowerPoint presentation as the first step in their teaching preparation, and this contributes to the structure of the lecture. Disappointingly, this is seen as the *only* step in teaching preparation by those who see delivery of content as the sum of their role in the classroom. Whether PowerPoint drives pedagogy or reflects it, there are suggestions that slide presentations impact negatively upon the nature of teaching. The populist view is that PowerPoint encourages student passivity (Ward, 2003) or even that PowerPoint makes us stupid (Tufte, 2003). This occurs within a context of increasing student diversity in which homogenization of teaching approaches is likely to be counterproductive for an audience requiring greater variation of teaching experience (Northedge, 2003a).

The current paper describes a practical means of helping a diverse student body towards active engagement with the discourse of their academic discipline (Northedge, 2003b), and towards the acquisition of skills needed to allow the development of expert understanding. Engaging students within the discourse as participants rather than observers has been described by Hendricks and Quinn (2000) as contributing towards a pedagogy of access. The mechanism presented in this paper exploits the widespread use of PowerPoint (which is typically used to support lectures in higher education), and combines it with the application of concept-mapping techniques in order to develop such a pedagogy.

At first sight, concept-mapping activities would seem to have little in common with the production of PowerPoint presentations. Concept maps are constructed explicitly to illustrate the links between ideas and to highlight multiple ways of connecting concepts within a developing expert-knowledge framework (Kinchin, 2000). Concept mapping is explicitly embedded within a constructivist approach to teaching with the aim of facilitating meaningful learning.

In contrast, PowerPoint is seen largely as a tool to deliver content (Szabo and Hastings, 2000) and, as such, can be seen as being supportive of an objectivist stance to teaching. Typically, PowerPoint presentations tend to over-emphasise a linear structure of knowledge to the exclusion of alternative perspectives, as a continuous authoritative voice that presents the definitive account. The linear nature of templates supplied with PowerPoint drives teachers down a highly sequential teaching pathway. Such an approach to teaching is complemented by a rote-learning approach by students (Hay and Kinchin, 2005). The tendency towards student passivity has been described as the "pedagogy of PowerPoint" by Tufte (2003), who has been highly critical of the software and what he sees as its negative impact on the quality of teaching and learning in higher education.

It is precisely this tension between concept mapping and PowerPoint that can be exploited by teachers to reveal and reflect upon students' multiple perspectives of the subject being taught, with the dual aim of improving the learning experience for students, and developing reflection among teachers by encouraging them to think beyond the linear sequence. Consideration of the properties of PowerPoint and of concept mapping is offered here, exploring the idea that coordinated multiple representations (*i.e.* linear PowerPoint and radial/integrated concept maps) may afford the development of a better shared understanding in the sciences (Kozma, 2003).

Highlighting multiple perspectives

1. The slide presentation

Novice teachers in higher education find it difficult to transform their expert knowledge structure into a suitable teaching structure that can support student learning (Kinchin and Alias, 2005). Production of morphologically distinct concept maps of the same content (described as spokes, chains and nets by Kinchin *et al.*, 2000) can help the novice teacher to reflect on the nature of these difficulties and appreciate the learning demand they are placing upon their students. Viewing multiple perspectives through mapping in this way helps novice teachers to formulate their learning objectives more productively (Kinchin and Alias, 2005), and increase the possibility of effective teacher-student dialogue (Kinchin, 2003).

The linear sequence of a PowerPoint presentation is analogous to a chain-type concept map, in which one idea follows on from another. Therefore, the construction of a PowerPoint sequence is equivalent to part of the mapping process described by Kinchin and Alias (2005); that of constructing a sequence of teaching that represents the focus on content. The transformation of this sequence into a more integrated framework shifts the focus from content to student learning, as the teacher considers how students might interact with it. Such transformation of knowledge structures is described by Shulman (1987) as a key pedagogical reasoning skill. The consideration of alternative frameworks of understanding in this way may help the teacher to resolve possible conflicts between objectivist positions (getting through the content) and constructivist positions (helping students understand) as described by Hughes and Hay (2001).

If left as a linear sequence, the weakness of PowerPoint highlighted by Tufte (2003) might be seen as a general weakness of any teaching that uses it. However, if seen as the first stage in the preparation of teaching, the sequentiality of PowerPoint can be seen as a tool to be exploited in the first stages of lesson preparation. What the subject-expert novice teacher is actually doing in his/her lesson preparation is to transform his/her expert knowledge into a manageable format for teaching. This format often ends up as a sequence of material, corresponding to a series of lectures. Sequentiality may be amplified within lectures by the unreflective use of PowerPoint templates, particularly when they are strewn with bullet points (Atkinson, 2005).

The focus on producing a PowerPoint presentation provides teachers with a concrete result for their activity and gives a focus on the immediate achievable aim of organizing a better lecture, what Guskey (2002) would call a 'proximal goal'. A more distal goal of considering alternative presentation structures may be to support the development of teachers' epistemological stance towards a more sophisticated, constructivist perspective that will align teaching more closely to the learning needs of their students (Howard *et al.*, 2000).

An excerpt from an unexceptional PowerPoint presentation is illustrated in Figure 1 in the typical printout format of six slides per page. The presentation exhibits a number of problems that, according to Tufte (2003), are characteristic of the cognitive style of PowerPoint. Tufte describes how bullet outlines conceal the analytical structure of the arguments presented by "leaving out the narrative between the points" (Tufte, 2003: 6). The narrative component is important as it provides coherence, and aids recall through its network of causal links and signposting (Laurillard *et al.*, 2000). Atkinson (2005: 9)

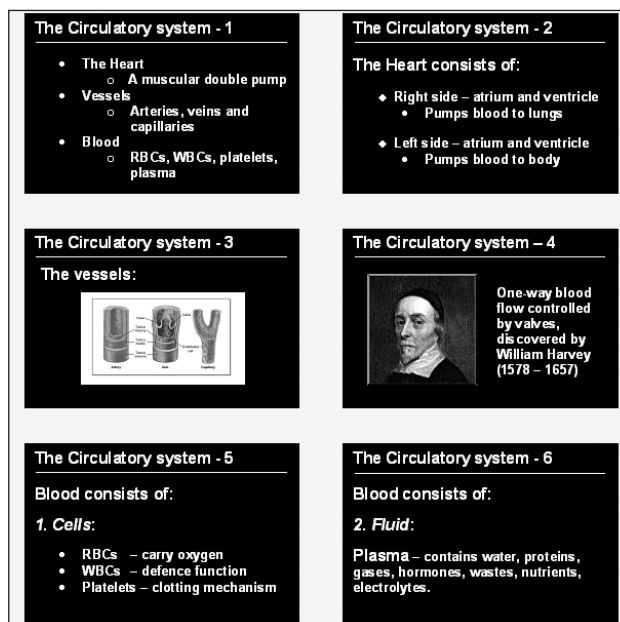


Figure 1. A sequence of PowerPoint slides on the circulatory system, shown as a typical six-slides-per-page printout.

adds to this condemnation by saying that bullet points "undermine the purpose of a presentation" as they "take aim at whatever is interesting and lively in a room and silently kill it". Additional problems with this presentation include the nature of the slide titles which add nothing to aid the understanding of the material other than to locate the slide within a linear sequence. Finally, ideas are forced to straddle two slides (eg. Figure 1: Slides 5 & 6), suggesting an artificial break in ideas. In combination, these provide students with additional obstacles to learning before they can start to grapple with the content of the lecture.

I acknowledge here that the linearity of a stereotypic PowerPoint presentation does not preclude the teacher's use of dynamic discussion techniques to weave some of the students' personal knowledge into a teaching session and to build linkages among the bulleted items through creative dialogue. Such a scenario is possible. However, my recent experience in over one hundred formal teaching observations suggests that such complementary mismatches between PowerPoint presentation structure and teaching approach are *not* common. The structure of the PowerPoint presentation is usually a good predictor of the teaching style expressed within the classroom and so makes an appropriate starting point in the consideration of how to promote more sophisticated teaching strategies.

2. The handout

Presenting information to accompany the PowerPoint presentation as a handout in the format illustrated in Figure 1 creates several additional learning disadvantages for the student:

1. The information is presented as a linear sequence that may be interpreted as a hierarchy of ideas. This may give false impressions (eg. that cells are a more important component of blood than plasma).
2. Links between ideas are not made explicit. The printing of material as isolated slides portrays an atomized structure of knowledge, learning of which is likely to be achieved by rote memorization rather than deep understanding.
3. Presenting information as a linear sequence in the pres-

entation *and* in the handout is likely to minimize interaction between the two. Linear sequences of information do not easily interact with each other or accommodate change, and so this may inhibit student progression of understanding (Kinchin, 2001).

- Without a way of signaling otherwise, all slides are implied to be of equal importance. However, some have an organising role (eg. slide 1 in setting the framework for the rest of the lecture) whilst others are presenting information.

If the intention of the PowerPoint presentation is only a delivery system of packages of information to be stored for later retrieval, then this format may be sufficient. However, in an increasingly student-centred higher education environment, in which meaningful learning is a central goal, such an approach to teaching is seen as failing to pay due respect to the needs of learners. If a more positive aim is intended and the presentation is designed to increase understanding, then PowerPoint can be seen as just one of the available cognitive tools (Mayer, 2001). In this case students might require additional support to complement their learning style and help them begin the construction of their own emergent expert understanding.

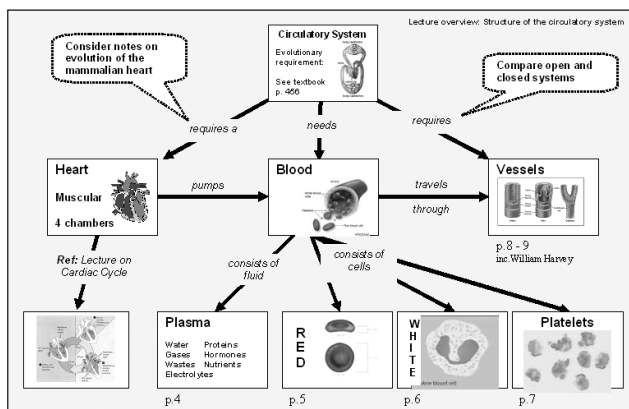
Arranging slides to form a concept map

Figure 2 represents information from the same lecture as Figure 1, but this time it is given in a concept map format. The concept map provides the student with a different format of information to consider. Variation in knowledge structures demonstrated in this way also relates to the distal (long-term) goal of teacher change (Guskey, 2002), and to developing a more sophisticated conception of teaching as knowledge construction rather than a naïve view of teaching as knowledge transmission.

The concept map arrangement in the handout shown in Figure 2 exhibits a number of advantages over the six-slides-to-a-page printout as a complement to the slide presentation:

- Links between ideas are made explicit and so avoids the creation of false hierarchies that may be implied by the order in which the slides are presented.
- The sequential structure of the presentation is complemented by the more integrated structure of the handout, increasing the possibility of interaction between the two. This may help to make the lecture supported by PowerPoint a less passive experience for the students.

Figure 2. Key slides from a PowerPoint presentation on the circulatory system, reorganized so that each slide forms a node within a concept map on the handout. In this format, the structure of the lecture is made explicit and reflects the lecturer's expert knowledge framework.



- Reference is included to related lectures (eg. lecture on cardiac cycle) so that students are helped to construct an integrated understanding of the whole course rather than of separated lectures.
- Reference is made to key pages of the course textbook for further reading.
- Key questions are shown as annotations to the ideas presented (within the two dotted-outline speech balloons).
- By acting as an advance organizer for a more extensive handout, detailed text can be avoided on each of the slides. Page numbers below the slides indicate where (within a hypothetical handout) more comprehensive notes may be found on blood components (pp. 4-7) and vessels (pp. 8-9). Such pages need not be restricted in layout to PowerPoint templates.

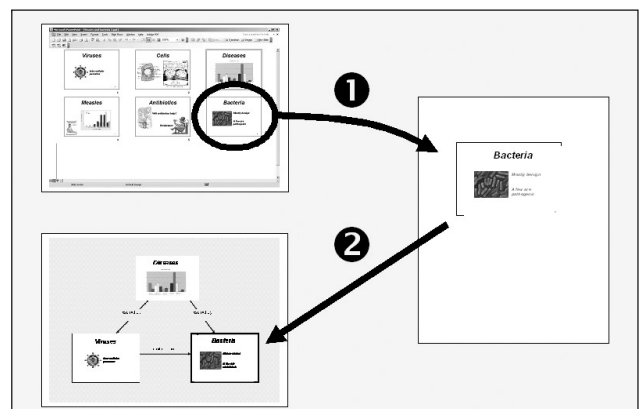
This concept map format of the material might be included at the front of a more detailed handout (or indeed as an opening slide within a presentation) to act as an advance organizer to set the scene for the lecture.

The presentation of a PowerPoint slide featuring a completed concept map that is in turn composed of other slides from the presentation, may present the students with too much information to process in one go. However, PowerPoint is a good tool to show the stages in construction of a map through a build sequence of slides (adding the nodes and linkages in an incremental way) so that students do not experience information overload, and may also appreciate the developmental nature of a concept map that depicts understanding.

Practicalities of slide manipulation

I have no doubt there are numerous ways in which it is technically possible to manipulate PowerPoint slides to create diagrams, like the one shown in Figure 2. I have found the least problematic method is to copy slides from PowerPoint to Word and back again. This is a relatively simple process and is summarized in Figure 3. However, it does use considerable computer memory. Therefore, to avoid problems, do not have any unnecessary applications running at the same time and have a CD or memory stick ready to transport your file as it will probably be too large to fit on to a floppy disk.

Figure 3. Manipulating PowerPoint slides in a two-step process: Step 1: Select the desired slide in the thumbnails view of PowerPoint. Copy the entire slide and import it into an open Word file. Paste the slide into a text box. Step 2: Select the text box from Word and paste it into a PowerPoint slide. This can then be re-sized and positioned just like any other image. The connectors and other labels required to construct a concept map can be added using the drawing tools within PowerPoint. The slides can then be printed and used as a handout and/or used as an advance organizer or summary slide for the PowerPoint presentation.

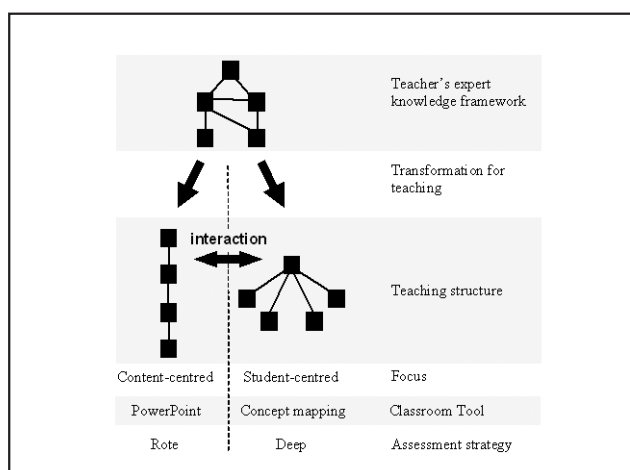


Conclusion: implications for teaching and learning

The comment was made by Hendricks and Quinn (2000: 456) that, “if we are committed to a pedagogy of access then we have a responsibility to ensure that our practice is inclusive: to make our understandings of epistemology clear to students and to be explicit about what our expectations are”. The mechanism described above recognizes multiple perspectives held by students and is a step towards their “epistemological empowerment”. This helps students to appreciate themselves as contributors to academic discourse rather than merely observers of it. Students “..cannot simply listen, absorb and imitate. They need to develop identities as members of their chosen knowledge community, so that they ‘think’ and ‘speak’ its discourse.” (Northedge, 2003a: 26). Passive observation of a PowerPoint presentation will not achieve this aim. However, rather than ditch PowerPoint (resistance to which would probably be considerable among university lecturers), I suggest that there should be more reflection about the way it is used. There needs to be consideration of PowerPoint’s strengths and weaknesses, recognizing the need to employ complementary tools that “afford” activities that generate learning (Laurillard *et al.*, 2000). The term, “affordances for learning”, was coined by Gibson (1979) in the field of environmental psychology. The value of this theory is now being recognized in its application to ICT-rich learning environments when describing the learning behaviours that are triggered by particular teaching approaches (see Chemero, 2003 for a critique of the theory, and Webb, 2005 for a discussion of pedagogical implications).

Figure 4 summarizes the pedagogical balance that may be promoted by considering the multiple perspectives that are supported by PowerPoint and concept mapping. The linear (PowerPoint) structure provides the focus on content, balanced by the radial (concept-mapping) structure that can introduce a more student-centred dimension, providing a fertile base for further learning (Hay and Kinchin, 2005). Current research is now starting to draw links between the morphology of knowledge structures (depicted by concept maps) and learning styles (deep vs. surface) that are used by

Figure 4. Transformations of the teacher’s expert knowledge framework can result in teaching structures that are dominated by linear sequences if supported by PowerPoint, or by more radial structures if supported by concept mapping. These teaching structures will have implications for the degree of student-centredness that is likely to be afforded, and may be related to assessment strategies that favour one or other mode. Interaction between the two teaching structures may help to achieve a pedagogical balance.



students (Hay, 2007). Such relationships may be seen to add to the perceptions of learning affordances offered by PowerPoint presentations that are strictly linear and to the likely assessment strategies that are considered appropriate to complement the teaching (Figure 4).

Tension between linear and radial/integrated knowledge structures might be the catalyst to initiate a teacher-student dialogue, inviting student access to the academic discourse. In so doing, PowerPoint use will migrate from its objectivist origins (Szabo and Hastings, 2000), towards a more constructivist orientation that will help align its use to more contemporary views of university teaching (eg. Nicholls, 2002; Ramsden, 2003). For this to happen, teachers need to be actively reflecting upon their PowerPoint presentations and the implicit messages that are imparted by the structures that are transmitted. I hope this paper will contribute to debate that considers the issue of PowerPoint-supported teaching in universities.

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References

- Atkinson, C. (2005) *Beyond Bullet Points: Using Microsoft® PowerPoint® to create presentations that inform, motivate and inspire*. Microsoft Press, Redmond, Washington.
- Chemero, A. (2003) An outline of a theory of affordances. *Ecological Psychology*, 15(2): 181 – 195.
- Gibson, J.J. (1979) *The ecological approach to visual perception*. Boston, MA. Houghton Mifflin.
- Guskey, T.R. (2002) Professional development and teacher change. *Teachers and Teaching: theory and practice*, 8(3/4): 381 – 390.
- Hay, D.B. (2007) Using concept maps to measure deep, surface and non-learning outcomes. *Studies in Higher Education*, 32(1): In Press.
- Hay, D.B. and Kinchin, I.M. (2005) *Conceptual typologies: Implications for individual learning and organisational structure*. Paper presented at the European Learning Styles Information Network (ELSIN) 10th annual conference, 13th -15th June, University of Surrey, UK.
- Hendricks, H. and Quinn, L. (2000) Teaching referencing as an introduction to epistemological empowerment. *Teaching in Higher Education*, 5(4): 447 – 457.
- Howard, B.C., McGee, S., Schwartz, N., and Purcell, S. (2000) The experience of constructivism: transforming teacher epistemology. *Journal of Research on Computing in Education*, 32(4): 455 – 465.
- Hughes, G. and Hay, D. (2001) Use of concept mapping to integrate the different perspectives of designers and other stakeholders in the development of e-learning materials. *British Journal of Educational Technology*, 32(5): 557 – 569.
- Kinchin, I.M. (2000) Concept mapping in biology. *Journal of Biological Education*, 34(2): 61 – 68.
- Kinchin, I.M. (2001) Concept mapping and progression in the National Curriculum. *Education Today*, 51(3): 3 – 7.
- Kinchin, I.M. (2003) Effective teacher-student dialogue: a model from biological education. *Journal of Biological Education*, 37(3): 110-113
- Kinchin, I.M. and Alias, M. (2005) Exploiting variations in concept map morphology as a lesson-planning tool for trainee teachers in higher education. *Journal of In-service Education*, 32(2): 363 – 385.
- Kinchin, I.M., Hay, D.B. and Adams, A. (2000) How a qualitative approach to concept map analysis can be used to aid learning by illustrating patterns of conceptual development. *Educational Research*, 42(1): 43 –57.

- Kozma, R. (2003) The material features of multiple representations and their cognitive and social affordances for science understanding. *Learning and Instruction*, 13(2): 205 – 216.
- Laurillard, D., Stratford, M., Luckin, R., Plowman, L. and Taylor, J. (2000) Affordances for learning in a non-linear narrative medium. *Journal of Interactive Media in Education*, 62: 1 – 19.
- Mayer, R.E. (2001) *Multimedia learning*. Cambridge, Cambridge University Press.
- Nicholls, G. (2002) *Developing teaching and learning in higher education*. London, RoutledgeFalmer.
- Northedge, A. (2003a) Rethinking teaching in the context of diversity. *Teaching in Higher Education*, 8(1): 17 – 32.
- Northedge, A. (2003b) Enabling participation in academic discourse. *Teaching in Higher Education*, 8(2): 169 – 180.
- Ramsden, P. (2003) *Learning to teach in higher education*. (2nd Edition) London, RoutledgeFalmer.
- Shulman, L. (1987) Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57: 1 – 22.
- Szabo, A. and Hastings, N. (2000) Using IT in the undergraduate classroom: should we replace the blackboard with PowerPoint? *Computers and Education*, 35: 175 – 187.
- Tufte, E.R. (2003) *The cognitive style of PowerPoint*. Graphics Press LLC, Cheshire, CT.
- Ward, T. (2003) I watched in dumb horror. *Education Guardian*. May 20. Available online at: <http://education.guardian.co.uk/egweekly/story/0,5500,959058,00.html>
- Accessed: 9th February 2006.
- Webb, M.E. (2005) Affordances of ICT in science learning: implications for an integrated pedagogy. *International Journal of Science Education*, 27(6): 705 – 735.

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