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A MULTI-DIMENSIONAL FRAMEWORK FOR ANALYSING CONCEPT MAPS

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Abstract. The hypothesis underlying this short paper is that conventional modes of assessing teachers do not provide a full picture about their learning about digital pedagogies when they are engaged in Continuing Professional Development (CPD) programmes. In this research study, therefore, teachers' were asked to draw a concept map at the beginning and end of three different kinds of computer course. These maps were analysed to discover what they revealed about the map makers' digital priorities. Numerical methods of scoring maps and analysis of content were found to be effective in studying the learning patterns of the group. However, an analysis of the maps as a holistic semiotic signs was found to be the most effective in revealing the priorities and motivations of individuals. One pair of hand drawn maps is used to illustrate how the semiotic framework devised for this study helped to identify details of the learners' position at two points in time. This paper also outlines the ways in which teachers took ownership of this mode of assessment.

1 Introduction

Continuing Professional Development (CPD) programmes for teachers about the uses of digital technologies are usually assessed by means of a multi-choice questionnaire or a linear, written essay. This kind of assessment of learning provides no opportunity for teachers to display their understanding of the multimodal digital communication possibilities in a visual way. What is missing is a multi-dimensional approach to assessment that acknowledges that digital communication has tended to decentralise the role of written language in making meaning. The term 'concept map' is being used throughout this short paper in the popular sense that associates a variety of forms and shapes for communicating ideas with a general notion of concept mapping. A multi-dimensional concept map can be defined as a multimedia, multimodal and multilayered assessment opportunity that acknowledges the role of students and their teachers as creators of web-texts. At best these texts can mix music, graphics, sound, and animation to be accessed by a wide public audience. Hyperlinks also extend the creators' opportunity to prioritise and layer ideas on the screen. Interactivity with an audience or another text creator also deepens communication awareness in new ways that traditional written tests do not exploit.

In the research project hand-drawn and digital concept maps were the focus of experimentation in innovative summative and formative assessment that included self and group assessment strategies. The aim was to offer teachers scope for expressing their understanding of computers and networks in modes that replicated some of the features of digital communication. Sixty teachers in CPD programmes about digital technologies were invited to draw 'concept maps' at the beginning and the end of the courses as an alternative to traditional testing. Three methods of semiotic analysis were piloted: the first was a scoring method adapted from the UK Impact2 Project (Mavers, Somekh et al. 2002). A connectivity score indicating cognitive activity was derived from diving the number of links into the number of nodes. This quantitative scoring method was found to be effective for tracing the patterns of learning in large groups. However, it was found to be unreliable as a single measure when the learning of individuals was under review. A simple content analysis, the second method, provided more qualitative information. However, a range of qualitative semiotic features within the drawings seemed to be conveying information that was different to the words or that stressed or undermined their meaning. As a result a third method of analysis was devised. This analytical framework (Figure one) was based on the work of several semioticians from the sociocultural school. This framework is designed draw out the qualities of concept maps as they are developed in multi-dimensions. Their different contributions to this framework are described in the next section.

2 The literature

Kress and van Leeuwen (Kress and Van Leeuwen 2007) are leaders of a school of semioticians who have widened the scope for analysing concepts by looking at multimodal examples of how the global society is using this form of communication. Kress and van Leeuwen (op cit) select, from contemporary magazines, newspapers and textbooks a variety of linear flow-charts influenced by the notion of networks. These networks offer a freer mode for the formation of ideas into associations or concepts that are not so dependent on hierarchical structures. They point out that mapping is particularly appropriate for interpreting the Internet itself where information is often freely available for those who have perfected their searching techniques. Kress and van Leeuwen (op. cit) also make an important distinction between hierarchical diagrams, which they see as

classificational, and networks, which they suggest, are more analytical. These references to networks also allude to the influence of computer networks in new structures for communicating new concepts. The ideas explained

Figure one: Emerging analytical framework for semiotic investigation

MCM features	Evidence	Key theorists
information and transmission		
Concepts to include words	Grouping of ideas and themes towards a key summarizing node; symbols used for ideas and how they are juxtaposed and connected in clusters; a classificational or an analytical design with some political implications: a hierarchical shape or network style map perhaps denoting authoritarian or liberal knowledge patterns.	Kress and Van Leeuwen 2007(second edition)
Modalities	The features of the map that promote veracity from the point of view of the map-maker- shading, colour, brightness etc.,	Kress and Van Leeuwen 2007(second edition) Mavers, Somekh & Restorick 2002
Compositional elements and their interrelations	Framing. Positions on the page, sizes, foregrounding and marginalising etc.	Kress and Van Leeuwen Mavers, Somekh & Restorick2002
Materiality of Meaning	Surface textures, inscriptions and additions	Kress and Van Leeuwen 2007(second edition) Mavers 2004
Dimensionality	Multilayering and hyperlinking	Kress and Van Leeuwen 2007(second edition) Mavers 2004
Constructive Learning		
Narrative	Trajectories that tell a story	Kress and Van Leeuwen 2007
Affectual factors, ludic qualities	Indications that the learning was not only cognitive but affective.	Kress and Van Leeuwen 2007(second edition)
Dynamics	direction of links and arrows: animation of images and lettering	Mavers 2004
Social Interaction		
Representations and interactions	Indications of the relationship between the map-maker and the viewer or audience	Kress and Van Leeuwen 2007(second edition) Jewitt 2003

by the semioticians suggested that the choice of multidimensional mapping might be ideal for representing computer concepts. The recent advances in digital mapping have increased the potential similarity between mapping and thinking in multi-layers like a computer network design.

In this study a framework of modes of analysis has been adapted from the relevant items in the list of topics covered in the tentative visual grammar in Kress and van Leeuwen's, *Reading Images: the Grammar of Visual* Design (revised 2007). This framework has also been enhanced by the Impact2 social semiotic studies (Somekh, Mavers et al. 2002; Jewitt 2003). Mavers' case studies provide more detail about analytical issues because she investigates the analysis of maps specifically. Her careful and respectful examination of children's graphic representations, or signs seeks to identify the variety of ways in which meanings are made on the page and on the screen (Mavers 2004; Mavers 2007; Mavers 2008 in press). Her detailed observations about children's practices provide exciting insights into their mastery of contemporary text making. She investigates texts made at school and autonomously at home, as drawing, as writing, and as multimodal combinations of writing and image. These extend to activities such as colouring, gluing and copying which are not normally given this much attention in schools or at home. Mavers looks in great detail at what has been represented in order to see what can be learnt about young people's meaning making. In many ways what emerges is that they are not given credit for their sophistication of their text making. Her study draws attention to the complexities of representation and communication, and how children readily adapt the ways in which they make texts in response to the particular social context. Their representations are subtly different in ways that indicate creative interpretation. Jewitt's studies in multimodal literacies (Jewitt 2002; Jewitt 2003; Jewitt and Kress 2003) bring a

further concentration on the affordances of multimodal resources that engage the learner in dynamic relationships and interrelationships with the topic. Whereas Jewitt and Maver's work focuses on the digital resources available to children at home and in classrooms, this study investigates how teachers make use of similar opportunities. The rationale was that concept maps seemed to offer a particularly appropriate method of investigating representations of new technologies, since the maps make extensive use of images and icons like computers, rather than conforming to tradition and privileging textual and numerical symbols.

In order to provide coherence in analysis the elements that these researchers identify as units of analysis in the framework have been divided into categories based on Pachler's identification of three cognitive theories: information transmission, constructivism and social interaction (Pachler 2005). These categories are intended to distinguish between details that denote the plain facts that have been learnt, the elements of construction and interpretation and, finally, evidence that the map maker is aware of the dynamic opportunities for interactive communication on networks. Because of the shortness of this paper, a pair of simple hand drawn-maps has been selected in the next section to show how the framework can help to illuminate the map-makers' meaning. However it is important to remember that this cannot be comprehensive as all maps are 'fascinating, cultural artefacts, full of unique detail and often aesthetically pleasing' (Mavers 2002 p. 191.)

3 A sample semiotic analysis of one pair of maps

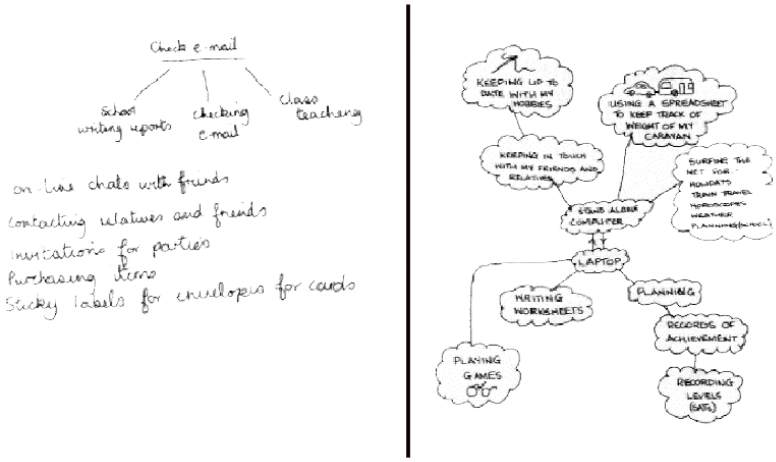

Figure Two: A pair of concept maps by Amy

In contrast to the methods advocated by Novak and Buzan, this mapping activity was not dependent on previous teaching of concepts or on prescriptive forms of mapping (Buzan 2002; Cañas and Novak 2007). Examples of Novak's concept map shapes and Buzan's radiant mind maps were shown to the teachers on three different kinds of course based on information transmission, constructivist and social interaction principles. But each cohort was advised to be as creative as possible in their mapping style. The teachers had 20 minutes to work on their map. The heading of each of these maps was the same for each cohort: the impact of computers on my personal and professional life. This topic was not intended as a means of covering the course syllabus, but to provide a vehicle by which the teachers could indicate their reactions to computers at these two points in time.

The two simple hand-drawn maps by Amy in Figure Two are used to illustrate briefly how an analyst would use the framework can be used by an analyst to supplement other information about her. In her questionnaire, for example Amy had rated her computer knowledge as 'little or none'. Amy's first map is typical of many of the first maps because it appeared that teachers who had not had much exposure to computers also seemed to find drawing a concept map challenging. Although Amy had been shown some examples of concept maps she was not able to translate this knowledge into her composition. In the second map, after a year's course in computers, her control of over composition is contrastingly confident and expansive. She has also illustrated the difference between her standalone and laptop computers by making the nodes a different size. She seems to have imbibed some key concepts as her administrative use of the laptop in school is oriented towards planning, creating resources and recording achievement. Two dynamic arrows between the laptop and the standalone indicate integrated use between them both, although it is not clear if Amy means through a network or simply by

carrying a storage device. From the constructive point of view the second map begins to offer some biographical detail and some humour. Her drawing of the caravan conveys her pleasure in what she can achieve with her computer. These references to the affective elements of learning were important in developing an understanding of motivation and of reluctance to engage with computers that were helpful to the tutor/researcher.

4 Summary and discussion

The analysis of Amy's two contributions suggests that a clear progression could always be seen between the two maps, but this was not the case. The semiotic framework offered new insights into the individuality of teachers' interpretations and the value of their different approaches to communicating learning. Furthermore, when the teachers in the social interaction CPD programme were invited to analyse their pairs of maps in groups, the ideas were articulated that threw new light on how individual teachers' learning progresses. From 2003-2006 some teachers in CPD programmes that included action research became interested in the potential of multi-dimensional mapping with their classes. The introduction of digital mapping and interactive whiteboards was a combination that underpinned a new trend in complex multi-dimensional collaborative mapping. After forming a working group, some of these teachers have published practitioner and academic studies in two e-journal volumes (Preston, Cuthell et al. 2007; Howell Richardson and Preston 2007). This ownership of the framework by the learners was possibly the most important outcome of this multi-dimensional mapping assessment study.

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