

Knowledge management in education and the contribution of Virtual Learning Environments

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“In the information society, knowledge forms the foundation for education and culture”¹

The field of knowledge management is of great importance in the commercial world, in part because technological economies are increasingly knowledge based², but also through a growing realization that intellectual capital is the key driver in organizational success³, and that an organization’s people are the locus of much of its knowledge. In education, it has received little attention^{4,5,6}, although there are notable exceptions such as Hargreaves⁷, the OECD⁸ and Sallis & Jones⁹. Whilst it is not unusual for techniques of management in education to lag behind those in the commercial world¹⁰, this seems surprising in this case, as education is surely all about cultivating, or at least sharing, knowledge¹¹.

The contribution of Management Information Systems

School management information systems (MISs), have long had a place within the information infrastructure of schools, but have had relatively little impact on actual classroom practice^{12,13,14,15}. This is perhaps because they do not capture the knowledge or information that teachers and managers actually use¹⁶, or because they were designed to meet accountability demands¹⁷. The recent DfES commissioned NFER report, on the use schools make of data to support the teaching and learning process, is particularly illuminating: despite the incorporation of data analysis tools within most MISs,

“Good practice emerged from the use to which the data was put rather than specific systems or tools... Rather than closed data analysis packages, school-devised systems and Excel spreadsheets were the most popular data management tools because they tracked individual pupils and allowed schools the flexibility to input internally generated data such as interim assessments and targets; i.e. such tools were easier to customize to the school and its particular needs and circumstances.”¹⁸

The existing, “sub-optimal” provision of MISs in schools¹⁹ has largely failed to address knowledge management needs. The development of Virtual Learning Environments (VLEs), and, crucially, their integration with school MISs to form synoptic Managed Learning Environments (MLEs), provides, if implemented with vision and an understanding of the wider knowledge management context, the opportunity to leverage the capacity of computers for information processing and communication to transform the quality of teaching and learning in our schools. A VLE, after all, is designed to manage the knowledge that is at the core of the school’s activity, *ie* teaching and learning. This is an important distinction, as

“Information systems can affect the critical process of knowledge construction and organization by changing the epistemic criteria used in knowledge construction and by changing the content of the material that emerges from the creation process.”²⁰

Open Source Development

Of course, a badly designed learning platform created without direct input from educators is as unlikely to transform learning as an MIS focussed on accountability and administration. Open source

development addresses under utilization of such provision^{21,22}, since in open source development, where teachers can be directly involved in the development process, “the software evolves to embody the values of the user community”²³, and teachers’ specific needs can be addressed²⁴. Tatnall and Davey argue that school management software

“Should empower ... an individual school by enabling it to make appropriate changes in the way the software operates”²⁵,

whereas in contrast,

“the cost structure of the products of the major commercial [VLE] suppliers tend to encourage central provision of VLEs and, it is argued, a degree of inflexibility in delivery”²⁶.

This latter approach seems to be that favoured by Becta for the forthcoming roll-out of learning platforms²⁷. Open source software development strategies, such as releasing early and often and user community involvement, fit closely with the participatory action research model²⁸, and with the reflective ‘tinkering’ that Hargreaves sees as crucial for knowledge creation in schools²⁹. The rapid and enthusiastic adoption of the Moodle VLE, without encouragement from central government or most local authorities, is a powerful example of the effectiveness of such an approach, as well demonstrating the way in which this software has directly addressed pedagogical and professional needs.

The contribution of Virtual Learning Environments

Capturing Teachers’ Knowledge

Quintas observes that

“For the majority of firms in the west, the priorities are the ‘capture’ of employees’ knowledge, exploitation of existing knowledge resources or assets, and improved access to expertise.”³⁰

One key difficulty for those seeking to do this in education is the high proportion of a teacher’s knowledge that is tacit rather than explicit³¹, and thus the challenge seems to be to find a way to externalise or codify the pedagogic insights which are “locked in the heads of individual teachers and protected by the privacy of their classrooms”³². Whilst some of this knowledge will undoubtedly remain tacit, VLEs have the potential to make much that pertains to this knowledge, such as lesson planning³³, online resources³⁴, assessment data³⁵, and even pupil-teacher discussions, explicit, capable of codification, and thus readily accessible storage. Moreover, such a knowledge mapping³⁶ naturally codifies the teachers’ knowledge into the categories which are meaningful for others’ professional practice³⁷. The development of curricular metadata vocabularies and taxonomies is relevant here. However the present and proposed schemes appear to be lacking in flexibility and would fail to leverage the power of the Internet to facilitate collaborative, social classification and sharing of resources in a way that Web 2.0 systems, such as Flickr, Del.icio.us or Technorati, do. Furthermore, the use of social taxonomies brings the knowledge of educators and co-learners to bear on the suggestions and alerts that the Secretary of State envisages forming part of future personal learning spaces³⁸.

Knowledge Sharing

Through computer networks, the above aspects of teachers’ working knowledge can be readily shared throughout the organization. Sharing information, which is certainly not uncommon in primary schools³⁹, seems key to organizational success in a knowledge based society⁴⁰, and makes possible the shared decision making on which a school’s growth as a learning organization depends⁴¹. VLEs provide the opportunity to share information at a far finer grained, and relevant, level than the relatively crude demographic and assessment results which a traditional MIS provides: access to a pupil’s prior work and discussion contributions on a particular topic or objective can

allow for better informed, more personalized teaching than merely knowing the results from an end of term test, even if disaggregated by learning objective.

This sharing can extend beyond the organization's boundaries and, while European Schoolnet's survey⁴² suggested that VLE usage was perceived principally as a tool for teachers to organize their own work, it also indicated a high level of usage of communication tools for professional collaboration. Furthermore, VLEs allow teachers to create content and share it with educators around the world⁴³, to work collaboratively on instructional design⁴⁴, and, by drawing together resources from outside an organization, make it easier for schools to absorb knowledge created elsewhere⁴⁵. Transfer and reusability of content is important if VLEs are to become effective knowledge management tools⁴⁶. Such reusability depends upon the development of interoperability standards, which is now a priority for national agencies throughout Europe⁴⁷: the Schoolnet paper provides an overview of some of the relevant standards⁴⁸, although Konrad perceptively warns that specification may reflect "market power rather than educational needs"⁴⁹. The enthusiastic adoption of the Moodle open source VLE, which at present provides its own, open format for resource exchange, suggests that teachers are more concerned with the practical aspects of sharing resources than in compliance with published standards, although it is also interesting to note the high level of reflection and debate amongst the educators and technologists participating in Moodle's support website⁵⁰.

Facilitating resource sharing between teachers is crucial to the promotion of effective knowledge management in schools, in a way in which the delivery of pre-packaged, commercial content is not. Making teacher's working knowledge readily accessible in this way, and then allowing others to adapt it to their own context, facilitates true knowledge transfer⁵¹, and provides a mechanism for validating knowledge by turning it "into practice which demonstrably and repeatedly works"⁵².

Knowledge Creation

The wealth of data and information that a fully populated VLE contains would allow new knowledge, for example in the form of trends, patterns and exceptions in student data, to be isolated through data mining techniques⁵³. Such techniques could facilitate better-informed decision-making in management and pupil support. The integration of MISs with VLEs would allow for the automation of such data-mining, with MISs automatically highlighting significant trends and exceptions within the VLE generated data, and providing indicators of pupil learning styles, strengths or weaknesses, allowing earlier intervention at pupil, class and school level, as well as providing an important evidence base for addressing school improvement issues. A VLE is also more accommodating "of the inherent complexity, sophistication and subtlety of professional life and work in educational institutions"⁵⁴ and facilitates analysis of qualitative data^{55,56}. My own analysis of St Ives' VLE log files alongside assessment data⁵⁷ has suggested that those pupils adopting a more holistic use of the VLE, by *eg* looking back over earlier quiz attempts or forum posts, received the greatest benefit: this analysis has subsequently informed the way in which the VLE is presented to pupils.

MIS Interoperability

Interoperability, and perhaps ultimately integration⁵⁸, with MIS software would seem to be important in ensuring the greatest benefit of VLEs from a knowledge management perspective⁵⁹, and greater relevance of MIS to classroom practice. The term managed learning environment (MLE) is used for systems in which VLE, MIS and communication functions are fully integrated⁶⁰, although as yet no significant level of integration has been achieved⁶¹. New products indicate that the commercial software houses are beginning to explore these issues, as Smith & Wild had anticipated⁶², and promoting such interoperability is a priority for Becta⁶³; however, my impression is that, at present, most of these products afford little more than crude import/export functionality or perhaps automated authentication and enrolment. Whether such offerings will represent 'best of breed' VLEs remains to

be seen⁶⁴, especially as Fulmer & Frank argue that the lack of attention paid to teaching and learning in most MISs has been a direct result of their construction outside the organizations that were to use them⁶⁵. Experience in the MIS field suggests that such integration may result in teachers and schools having to adapt their own practice to suit the system⁶⁶, with a consequent tightening of control between education authorities and schools, and between senior management and teachers⁶⁷. Becta's proposal⁶⁸ for a UK version of the open Schools Interoperability Framework⁶⁹ is of importance here. Further progress would be facilitated if the databases underlying MISs and VLEs were openly documented and afforded direct read/write access to other authenticated applications: whilst commercial MIS suppliers can readily add code to read and write data to an open source VLE's database, such access in the other direction is impossible or prohibitively expensive. It is unclear how, under such restrictions, schools can genuinely be said to 'own' the data stored in their MISs⁷⁰.

Other benefits

There may be further potential for VLEs to support knowledge creation and organizational learning⁷¹. Hargreaves sees knowledge creation as rooted in interactive learning⁷², and believes that factors, which a VLE might promote, such as placing value on task related expertise among staff rather than organizational status and a willingness to tinker and experiment with new ideas in an ad-hoc way, are likely to foster it⁷³. Furthermore, the social constructivist paradigms, prevalent within VLE use in the Higher Education sector and overseas, could apply to teachers as well as learners: the OECD asserts the need for a move from working and learning alone to a model in which "the co-production of knowledge with colleagues [is] a natural part of a teacher's professional work"⁷⁴, and staff use of VLE tools provides for such activities. Nor should knowledge creation in schools be limited to the teaching staff – pupils using VLE tools to author content are themselves creating knowledge artefacts⁷⁵. Indeed, the content of online discussion threads forms an important reusable resource of problems and solutions⁷⁶.

One further area, which might fit under the umbrella of knowledge management, is accountability⁷⁷. The sharing of working practice described above would do much to establish a mechanism for accountability between teachers and their pupils, amongst colleagues and, of course, to management, without being beset by the dangers of an accountability led system of which Thorn warns⁷⁸.

From the evidence above it seems clear that, correctly implemented, a VLE can provide much of the

"Infrastructure to support knowledge management in education [that] will be needed... [without which] schools, colleges and universities cannot truly become the learning organizations that are essential to 'schooling for tomorrow'"⁷⁹.

Design of a Managed Learning Environment

The aims here have to be:

- to decrease the time staff spend on administrative tasks by ensuring that information need be entered only once and is then readily available;
- to increase teacher effectiveness;
- to promote learner autonomy, personalization of learning and closer home-school links; and
- to facilitate the management of teachers' subject, pedagogic and pupil knowledge through the provision of tools for storage, classification, sharing, communication and collaboration.

Integrated MIS/VLE systems should:

- give priority to teaching and learning by integrating timetabling, planning, assessment and resources;

- facilitate the sharing of pupil information between all those teaching a pupil; allow planning and assessment to be readily monitored;
- provide a single integrated view of all the data held on any given pupil;
- incorporate tools to support teachers' and managers' analysis of performance at fine-grained levels, and assess the effect of interventions;
- improve communication within the school and between school and home;
- facilitate opportunities for pupils to take greater responsibility for their learning; and
- be accessible from home.

My work over the 2004-05 academic year piloting Moodle⁸⁰ has gone a long way to meeting a good number of these objectives, although the 'single integrated view of all the data held on any given pupil' remains a long way out of reach at present, and really is the *sine qua non* of an effective MLE. Put simply, in any discussion about a pupil, it should be possible to have an overview, plus the ability to drill down into the detail, of all that a school knows about them – contact details, medical records, incident reports, house points, clubs, grades, exam scores, timetable, reports, scores on last night's homework, the objectives for their lessons today, what books they've borrowed, and in the case of computer based work, the work itself. Furthermore, by providing access to this data to pupils and their parents, such provision can facilitate a stronger sense of learner autonomy and far closer links between school and home. All this data is in most school, in one system or another; what's needed is a way of getting at it in one place, to give a synoptic view of the learner, their achievements and progress. Of course, analysis and comparison would be of value too, particularly for management, but I'd hate us to lose sight of the individual's importance – and this surely is the basis of personalized learning⁸¹.

¹ Smith, D & Wild, P (2001) The future of school information systems, in Visscher, A J, Wild, P, Fung, A C (eds) *Information technology in education management*, Dordrecht, Kluwer, p152

² Sallis, E & Jones, G (2002) *Knowledge management in education: enhancing learning and education* London, Kogan Page, p xii

³ Osorio, J, Zarraga, C, & Rodriguez, J (2001), Educational centres as knowledge organizations training future knowledge workers: the role of IT, in Nolan, C J P, Fung, A C W, & Brown, M A (eds), *Pathways to institutional improvement with information technology in educational management*, Boston, Kluwer Academic Publishers, p41-42

⁴ Organisation for Economic Cooperation and Development (OECD) (2000) *Knowledge management in the learning society*, OECD, Paris, p70

⁵ Sallis & Jones, p xiv

⁶ Thorn, C (2003) Data use in the classroom, in Selwood, I D, Fung, A C W, O'Mahony, C (eds) *Management of education in the information age: the role of ICT*, Dordrecht, Kluwer Academic, p22

⁷ Hargreaves, D (1999) The Knowledge-Creating School, *British journal of educational studies* 47(2) p122-144

⁸ OECD

⁹ Sallis & Jones

¹⁰ Smith & Wild, p140

¹¹ OECD, p70

¹² Visscher A & Wild P (1997) The potential of information technology in support of teachers and educational managers managing their work environment, *Education and Information Technologies* 2, p263-274

¹³ Fulmer, C & Frank, F (1997) Developing information systems for schools of the future, in Fung, A C, Visscher, A J, Barta, B-Z, Teather, D C (eds) *Information technology in educational management for the schools of the future*, London, Chapman & Hall

¹⁴ British Educational Communications and Technology Agency (Becta) (2005a) *School Management Information Systems and value for money*, Coventry, Becta

¹⁵ Kirkup, C, Sizmur, J, Sturman, L & Lewis, K (2005) *Schools' Use of Data in Teaching and Learning*, Slough, NFER

-
- ¹⁶ Quintas, P (2002) Managing knowledge in a new century, in Little, S, Quintas O & Ray, T (eds), *Managing Knowledge*, London, Sage, p8
- ¹⁷ Nolan, C J P & Lambert, M (2001) Information systems for leading and managing schools: changing the paradigm, in Nolan, C J P, Fung, A C W, Brown, M A (eds), *Pathways to institutional improvement with information technology in educational management*, Boston, Kluwer Academic Publishers, p79
- ¹⁸ Kirkup *et al*, p1
- ¹⁹ Becta 2005a
- ²⁰ Pentland, B (2003) Information systems and organizational learning in Galliers, R D & Leiner, D E (eds) *Strategic Information Management*, Oxford, Butterworth-Heinemann, p534
- ²¹ European Schoolnet (EUN) (2003) *Virtual learning environments for European schools*, Brussels, European Schoolnet
- ²² Gill, C & Shaw, S (2004) *Specifying and purchasing VLEs: the school perspective*, online at ferl.becta.org.uk/content_files/pages/news_events/events/2004/January/8_spec_shaw_gill.doc
- ²³ Dougiamas, M & Taylor P (2003) Moodle: Using Learning Communities to Create an Open Source Course Management System, *World conference on educational multimedia, hypermedia and telecommunications* 2003(1), p171-178.
- ²⁴ Kirkup *et al*, p41
- ²⁵ Tatnall, A & Davey, B (2001) Open ITEM systems are good ITEM systems, in Nolan, C J P, Fung, A C W, Brown, M A (eds), *Pathways to institutional improvement with information technology in educational management*, Boston, Kluwer Academic Publishers, p66
- ²⁶ Konrad, J (2003) Review of educational research on virtual learning environments [VLE] - implications for the improvement of teaching and learning and access to formal learning in Europe, *European conference on educational research* University of Hamburg 17-20 September 2003
- ²⁷ Becta (2005b) *An introduction to learning platforms for school leaders*, Coventry, Becta, p5
- ²⁸ Dougiamas & Taylor
- ²⁹ Hargreaves
- ³⁰ Qunitas, p9
- ³¹ OECD, p71
- ³² Hargreaves, p124
- ³³ British Educational Communications and Technology Agency (Becta) (2003) *A review of the research literature on the use of managed learning environments and virtual learning environments in education, and a consideration of the implications for schools in the united kingdom*, Coventry, Becta, p35
- ³⁴ *ibid*, p29
- ³⁵ Haughey, M (2003) The impact of ICT on the work of the school principal, in Selwood, I D, Fung, A C W, O'Mahony, C (eds) *Management of education in the information age: the role of ICT*, Dordrecht, Kluwer Academic
- ³⁶ Davenport, T H & Prusak, L (2000) *Working knowledge: how organizations manage what they know* Boston MA, Harvard Business School Press, p72-80
- ³⁷ Hargreaves, p125
- ³⁸ Kelly, R (2005) Secretary of State's foreword to *Harnessing Technology*, London, DfES
- ³⁹ Nolan & Lambert, p72
- ⁴⁰ Reyes, M (1997) The impact of organisational culture on the success of information technology projects, in Fung, A C, Visscher, A J, Barta, B-Z, Teather, D C (eds) *Information technology in educational management for the schools of the future*, London, Chapman & Hall, p76
- ⁴¹ Nolan & Lambert, p83
- ⁴² EUN
- ⁴³ Becta 2003, p37
- ⁴⁴ Ganesan, R, Edmonds, G S, & Spector, J M (2002) The changing nature of instructional design for networked learning, in Steeples C & Jones C (eds), *Networked learning: perspectives and issues* London, Springer-Verlag
- ⁴⁵ Quintas, p7
- ⁴⁶ Becta 2003
- ⁴⁷ EUN
- ⁴⁸ *ibid*, p30
- ⁴⁹ Konrad
- ⁵⁰ <http://moodle.org/>
- ⁵¹ Hargreaves, p131-2
- ⁵² Hargreaves, p128

-
- ⁵³ Wild P, Smith D & Walker J (2001) Has a decade of computerisation made a difference in school management? in Nolan, C J P, Fung, A C W, Brown, M A (eds), *Pathways to institutional improvement with information technology in educational management*, Boston, Kluwer Academic Publishers
- ⁵⁴ Nolan & Lambert 2001, p83
- ⁵⁵ *ibid*, p79, p83
- ⁵⁶ Dringus, L & Ellis, T, Using data mining as a strategy for assessing asynchronous discussion forums, *Computers & Education* 45, p141-160
- ⁵⁷ Berry, M (2005), *A virtual learning environment in primary education*, online at www.worldcitizens.net/ftp/Primary%20VLE.pdf, p15
- ⁵⁸ Smith & Wild
- ⁵⁹ Visscher, A (2001), Computer-assisted school information systems: the concepts, intended benefits, and stages of development, in Visscher, A J, Wild, P, & Fung, A C W, *Information technology in educational management: synthesis of experience, research, and future perspectives on computer-assisted school information systems*, Dordrecht, Kluwer Academic Publishers, p15
- ⁶⁰ Becta 2003
- ⁶¹ Gill & Shaw, p4
- ⁶² Smith & Wild
- ⁶³ Becta 2005a
- ⁶⁴ Gill & Shaw, p5
- ⁶⁵ Fulmer & Frank, p124
- ⁶⁶ Visscher, p15
- ⁶⁷ Tatnall, A & Pitman A (2003) Information and control in educational management, in Selwood, I D, Fung, A C W, O'Mahony, C (eds) *Management of education in the information age: the role of ICT*, Dordrecht, Kluwer Academic, p81
- ⁶⁸ Becta 2005a
- ⁶⁹ <http://www.sifinfo.org/>
- ⁷⁰ Becta 2005a, p22
- ⁷¹ OECD, p79
- ⁷² Hargreaves, p141
- ⁷³ *ibid*, p126
- ⁷⁴ OECD, p74
- ⁷⁵ Esienstadt, M & Vincent, T (2000), Introduction to the 2000 printing, in Esienstadt, M and Vincent, T (eds) *The knowledge web: learning and collaborating on the net*, London, Kogan Page, p xii
- ⁷⁶ Kawachi, P (2003) Initiating intrinsic motivation in online education: review of the current state of the art, *Interactive Learning Environments* 11(1), p76
- ⁷⁷ Sallis & Jones, p xv
- ⁷⁸ Thorn
- ⁷⁹ OECD p88
- ⁸⁰ Berry
- ⁸¹ Department for Education and Skills (DfES) (2005) *Harnessing Technology – transforming learning and children's services*, London, DfES.