15

Representing a body of knowledge for teaching, learning and assessment

Don Sheridan
MSIS Department, School of Business, The University of Auckland Auckland, New Zealand, e-mail: d.sheridan@auckland.ac.nz

David White
MSIS Department, School of Business, The University of Auckland Auckland, New Zealand, e-mail: d.white@auckland.ac.nz

Abstract

As Internet-based professional training becomes universally accepted, national and international standards for professional groups may become a dominant and governing force. Educators and trainers will be expected to demonstrate the relevancy of their programmes in the context of bodies of knowledge which have a wide acceptance. Universities will feel the pressure to meet or exceed the performance of technical institutions and commercial institutes to justify their tuition costs. A university degree in computer science no longer guarantees a job. This paper will discuss the application of a taxonomy in computer science to a computer- supported learning system and its implication for planning and managing one's professional career.

Keywords

Informatics, information systems, economics and business administration, curriculum (general), role of CIT, taxonomies, academic requirements, business and industry requirements

Informatics in Higher Education F. Mulder & T. van Weerts (Eds.)

1 INTRODUCTION

This paper opens with several definitions for the term 'discipline' and from these selects one, the notion of an 'ordered system', as the lead-in to a discussion of several examples of ordered systems or taxonomies of computer science. To maintain and extend the computer science taxonomy or body of knowledge we argue for a computer-supported learning system (CSL)which would represent the status of the universal, as well as the personal body of knowledge (BoK). The CSL not only provides access to the BoK and its knowledge elements, but also to learning materials, assessments and assessment results.

It has been said that 'what gets measured gets maintained'. In this instance, if we know how knowledge elements are assessed, then we have specific examples of the taxonomy in action. In the style of a debate we first consider the resolution.

Resolved
Informatics is a discipline and shares attributes in common with other disciplines and professions.

The word discipline in this statement can be interpreted in many ways.

- **Rules or methods**
  On one level we can think of our discipline in terms of rules or methods which include the early learning of the syntax of programming languages and the application of logic coupled with an understanding of the natural structures of informatics.
- **Mind-set or mode of thinking**
  As we make a greater commitment to our field we develop a mind-set or mode of thinking which arises from the deep understanding of systems theory and its application.
- **Professional code of operation**
  In addition, as a professional we become an active member of an informatics association and recommend and follow the code of ethics of our society. In this sense the discipline of informatics as a profession includes a wider acknowledgement of our role in our environment and governs our general behaviour in subtle but important ways.
- **Body of knowledge**
  Finally, our discipline is a body of knowledge and in teaching our discipline we articulate it as an ordered system of groups or categories, with natural relationships based upon principles and laws which govern its composition and formation.

For the purposes of this paper we wish to discuss informatics as a body of knowledge and also our method of representing the body of knowledge for teaching, learning and assessment. More particularly we wish to describe informatics in the context of an education in management science and information systems.

2 BODY OF KNOWLEDGE (BOK)

A variety of bodies of knowledge (BoKs) for computer science and information systems have been developed over the years, based upon numerous studies by individuals and professional organizations. See for example Couger (1973), IEEE (1980), ACM (1983) and DPMA (1986)). The most substantial of these bodies of knowledge is IS'95 (Longenecker *et al.*, 1995), a model curriculum in information systems (IS), proposed by the Association for Computing Machinery (ACM), the Association for Information Systems (AIS), and the Data Processing Management Association (DPMA). IS'95 details hundreds of knowledge elements and classifies these in several ways including the use of a taxonomy of educational objectives (Bloom,1956). Combinations of the knowledge elements form units which in turn form the basis of courses of study in IS. The curriculum model of the Information Resources Management Association (IRMA, 1996) is another articulation of the information systems field. It takes a more generalized approach by providing a list of recommended papers including the objectives and topics to be covered.

At the University of Auckland, School of Business, we have developed a computer-supported learning (CSL) system with an Internet browser interface delivering active pages generated by Microsoft ASP + COM objects from a database engine mounted on an Windows NT Server (Sequent NUMA-Q 2000).

The CSL data model shown in Figure 1 incorporates the attributes necessary to represent the detail of the IS'95 curriculum model and other BoKs while providing the practical necessities such as: on-line testing in a secure environment, web-based grade book, web pages for guidelines, assignments, news, e-mail, resource booking (computer labs, appointments with tutors) and batch generation and marking of off-line tests.

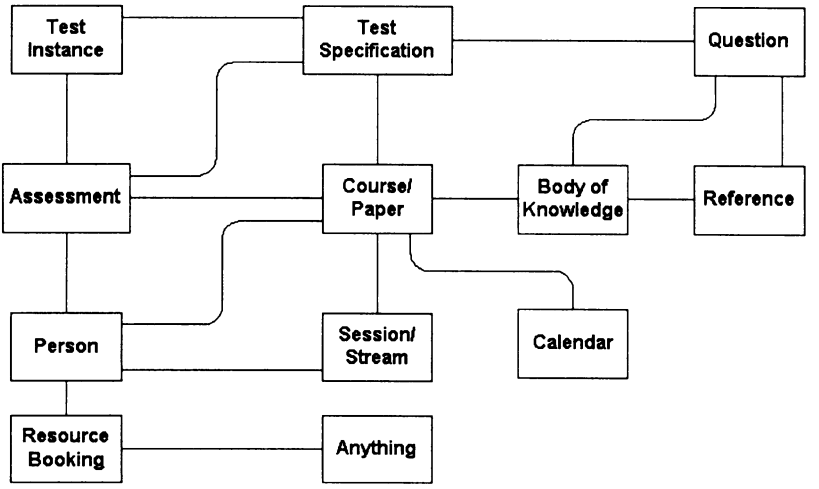

Figure 1 CSL data model.

CSL is used to link the BoK of IS with instances of the BoK knowledge elements as reflected in papers, instructional objectives within papers and assessments (see Figure 2). It is also quite likely that professionals (instructors, consultants, experts) will wish to augment the official BoK with knowledge elements of their own (as presented in Figure 3).

3 USE OF THE COMPUTER-SUPPORTED LEARNING SYSTEM

We have considered various scenarios for the use of the computer-supported learning system.

- Persons may maintain a subcomponent of a BoK on their laptop (for example) and hyper link to their own digital libraries.
- As new knowledge elements are created individuals may wish to add these to the global BoK (following peer review).
- Individuals may wish to put their personal BoK on-line as a networked-personal BoK for others to use or to fill-out or augment their own BoKs (see Figure 3).

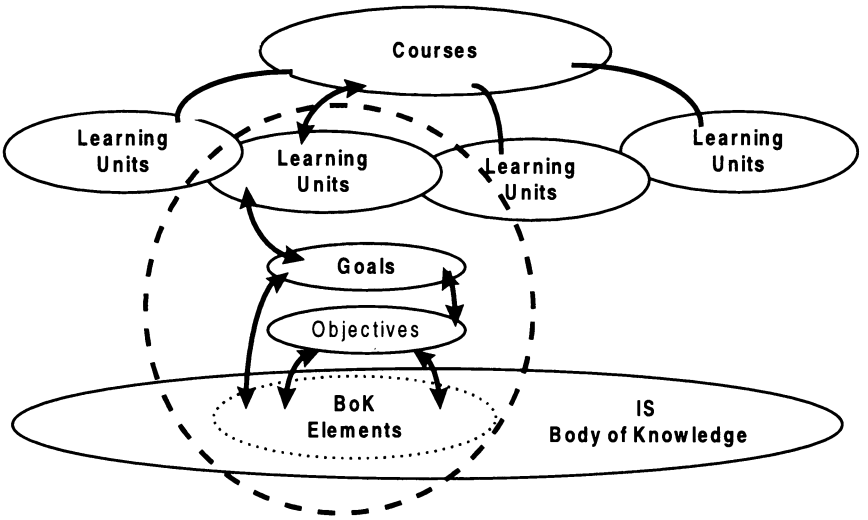

Figure 2 Linking the BoK of IS with instances of the BoK knowledge elements.

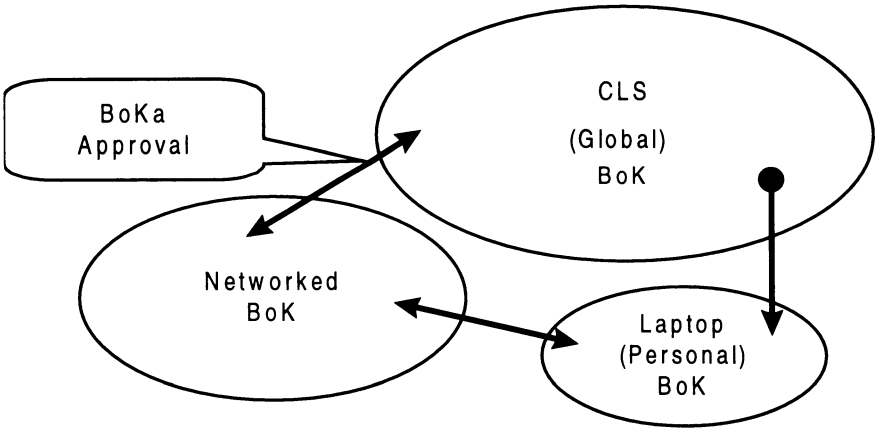

Figure 3 Augmentation of BoK with other professionals' knowledge elements.

We imagine that there may need to be a BoKa, an administrator who determines if and when additions to the professional BoK are warranted.

We intend to use BoKs within CSL to generate a number of educational business options such as certificate and diploma programmes, post-graduate (upgrading) seminars as well as supporting government approved training (NZQA

= New Zealand Qualifications Authority, see Figure 4). All of these services will be provided via the Internet.

Professions such as medicine and engineering require continuous post-graduate education. In computer science and information systems the ACM Code of Ethics, Art. 2.2, requires us to 'acquire and maintain professional competence' (Anderson, 1992). We believe that sophisticated, web-based educational resources will be a common method of meeting our upgrading needs in the future.

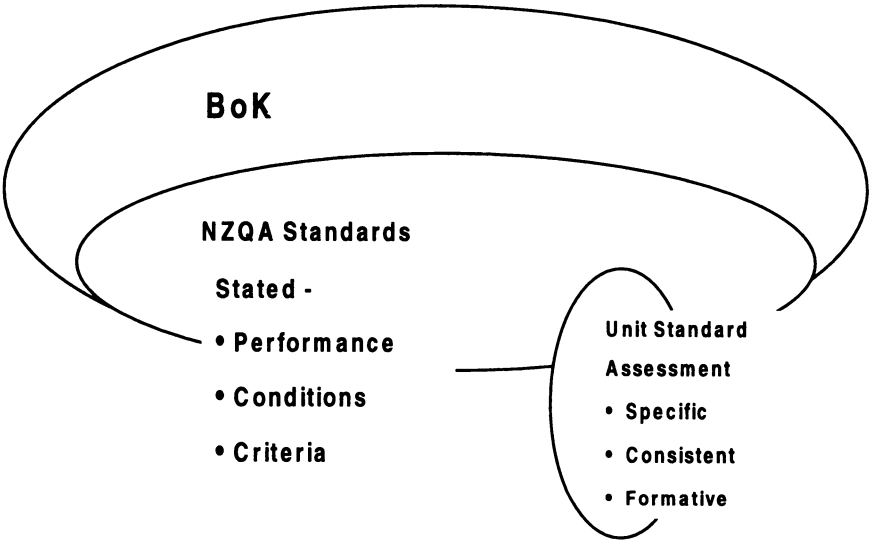

Figure 4 New Zealand Qualifications Authority (NZQA) standards as a BoK.

4 CSL IN ACTION

At the University of Auckland CSL has completed it's third semester with hundreds of students accessing it per day for supervised or external on-line quizzes, grade book queries (marks) or resource bookings. In semester 97B we will be adding more accounting and economics papers, as well as some post-graduate business statistics courses and examples of the national physics examinations. An Intranet accessible version of CSL will be providing still and motion video with audio support to the university-based workstations and lecture theatres during this semester.

Student information is replicated from the university enrolment system daily providing class lists which can then be divided into streams. Departmental staff maintain details of staff assignments to papers which then provides the basis for access security. The staff are then able to:

- specify all details of assessments for the course which are then available to the students via the WWW;

- define the Reference/BoK Network (readings, papers, lab notes, etc. for the course);
- prepare questions, each of which points to at least one reference;
- define test specifications based on the selections of the questions;
- assign a test specification to an assessment;
- make the test which is delivered via the WWW available at a specific time and place.

After the student takes a test, feedback is provided either:

- immediately after each question;
- immediately after the test;
- by e-mail.

This feedback can consist of both or either the correct answers or a pointer to the reference where the answer can be found.

Students are able to access and download all course resources and view their coursework marks via the WWW.

Different instructors are using CSL in many different ways. For instance in one course students take a 15 minute supervised quiz in the week before each lecture, the results of which are then available to the instructor to use to tailor the lecture. In another case large question banks are made available for learning/revision quizzes which the student can take at anytime.

5 CONCLUSION

It has been a challenge to transform a BoK from hard copy to a real-time, interactive learning application. The data model has more than two hundred tables and one thousand attributes. Dynamically linking knowledge elements of a BoK directly to a test item on an assessment and building a course of studies from associated references is an on-going project.

At the beginning of this paper we resolved: 'Informatics is a discipline and shares attributes in common with other disciplines and professions'. We have presented examples of how informatics is an ordered system. We have linked that ordered system, a body of knowledge, to another system which provides professional training (CSL).

The BoK we prefer (IS'95) is composed of attributes of our discipline at a manageable and discrete level. It is not a collection of facts and rules, as in a knowledge base, but rather a reasonably granular description of the various forms of knowledge which need to be possessed to work capably in informatics. We would argue that if science is organized knowledge (Spencer, 1861) then the BoK (IS'95) and its connection to CSL attests to our ability to organize our knowledge and systematically manage its growth.

6 REFERENCES

Anderson, R.E. (1992) ACM code of ethics and professional conduct. *Communications of the ACM*, **35** (5), 94- 99.

ACM (1983) *ACM recommendations for information systems, volume II.* ACM Committee on Computer Curricula of the ACM Education Board, ACM, New York.

Bloom, B.S. [ed.] (1956) *The taxonomy of educational objectives: Classification of educational goals. Handbook I: The cognitive domain.* McKay Press, New York.

Couger, J. [ed.] (1973) Curriculum recommendations for undergraduate programs in information systems. *Communications of the ACM*, **16** (12), 727-749.

DPMA (1986) *DPMA Model Curriculum: 1986.* DPMA, Park Ridge IL.

IRMA (1996) *The information resources management curriculum model (IRMCM): An international curriculum model for a 4 year undergraduate program in IRM.* A joint activity of IRMA and DAMA. IRMA, Harrisburg PA.

IEEE (1980) *Draft report on MSE-80: A graduate program in software engineering.* IEEE Software Engineering Subcommittee of the Computing Society Education Committee, IEEE, Los Alamitos CA.

Longenecker, H.E. Jr., Clark, J.D., Couger, J.D., Feinstein, D.J. and Clark, J.T. (1995) *IS'95: Model curriculum and guidelines for undergraduate degree programs in information systems.* A joint activity of DPMA, ACM, ICIS and AIS. School of CIS, University of South Alabama, Mobile AL.

Spencer, H. (1861) *Education*, Chap. 2. As quoted from *The Columbia dictionary of quotations*, Columbia University Press (1993).

7 BIOGRAPHY

Donald P. Sheridan is associate professor of the MSIS department and director of the Management Teaching Technology Unit, School of Business, University of Auckland. He was an associate professor of MIS and director of the Training Technologies Group, Dalhousie University, Halifax, Nova Scotia, Canada in 1985-1995. From 1980 to 1985 he was officer-in-charge of computer-assisted learning at the Canadian Forces Fleet School in Halifax. He completed his doctoral work at the University of Alberta under the supervision of Drs Steve Hunka and Gene Romaniuk, the pioneers who started it all with an IBM 1500 system and to whom much is owed.

David C. White B.E.(Hons) is a systems engineer who has a wide range of experience with local and multinational corporations since 1969. He is a part-time lecturer in information systems analysis and design at the University of Auckland. He has also taught in the areas of database design and expert systems. Currently he

is involved in a project building a computer- supported learning (CSL) system. Primary areas of interest are in modelling and user interface design.