DOCUMENT RESUME

ED 477 098		IR 021 826
AUTHOR	Stuckey, Bronwyn; Hensman, Jim; Hofmann, Tobias; Dewey, Barbara; Brown, Helen; Cameron, Sonja	
TITLE	Debunking the Buzz Words Or Can Hermeneutic Analysis Be Used To Evaluate Pedagogically Based Learning Objects Designed from Constructivist Epistemological Ontologies Defined in XML Metadata?	
PUB DATE	2002-06-00	
NOTE	7p.; In: ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Proceedings (14th, Denver, Colorado, June 24-29, 2002); see IR 021 687.	
AVAILABLE FROM	Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: http://www.aace.org/DL/.	
PUB TYPE	Information Analyses (070) -- Speeches/Meeting Papers (150)	
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.	
DESCRIPTORS	Computer Assisted Instruction; Constructivism (Learning); Data Analysis; *Epistemology; *Hermeneutics; Knowledge Representation; Metadata; Phenomenology; Programming Languages	

ABSTRACT

Arguably the biggest "buzz word" of the current year has been "learning or knowledge object". To understand the learning object and why it should be such a highly desirable commodity, it is necessary to unpack not only this concept but more importantly revisit some contributing concepts and constructs (more buzz words) that support the building of truly pedagogically informed reusable objects (Boyle & Cook 2001). The words and relationships explored in this paper are: learning or knowledge objects--the desirable construct in today's E-learning environment; ontologies and ways of expressing them through topic maps as they allow users to define and describe the components of an entity; metadata and XML used to create categorize, label and communicate the value of these objects; and hermeneutics and phenomenology as they refer to the interpretation of experience and events and evaluation of learning events. (Contains 23 references.) (Author)

Debunking the Buzz Words OR Can hermeneutic analysis be used to evaluate pedagogically based learning objects designed from constructivist epistemological ontologies defined in XML Metadata?

Bronwyn Stuckey
Queensland University of Technology, Australia
b.stuckey@qut.edu.au

Jim Hensman
Coventry University, UK
j.hensman@coventry.ac.uk

Tobias Hofmann
Bauhaus University Weimar, Germany
tobias.hofmann@medien.uni-weimar.de

Barbara Dewey
University of Tennessee, USA
bdewey@utk.edu

Helen Brown
BECTA, UK
helen_brown@becta.org.uk

Sonja Cameron
University of Glasgow, UK
s.cameron@arts.gla.ac.uk

Arguably the biggest 'buzz word' of the current year has been 'learning or knowledge object'. To understand the learning object and why it should be such a highly desirable commodity, we need to unpack not only this concept but more importantly revisit some contributing concepts and constructs (more buzz words) that support the building of truly pedagogically informed reusable objects (Boyle & Cook 2001). The words and relationships explored in this paper are:

- **Learning or knowledge objects** - the desirable construct in today's E-learning environment.
- **Ontologies** and ways of expressing them through **topic maps** as they allow us to define and describe the components of an entity
- **Metadata and XML** used to create categorise, label and communicate the value of these objects
- **Hermeneutics and phenomenology** as they refer to the interpretation of experience and events and evaluation of learning events

Learning or knowledge objects

Learning objects (also known as knowledge or instructional objects) are digital learning events that are discrete, reusable, able to be aggregated and are tagged with defining Metadata. The impetus for the development of learning objects comes as much from not wanting to reinvent the wheel as wanting to find ways to adequately define and categorise online instructional events. The form, size and shape of these learning objects can be as varied as the respective face-to-face events from lecture, course or discussion to simulation and role-play.

Downes (2001) succinctly describes the programming roots of learning objects. *To delve more deeply into the construction and organization of learning objects, it is necessary to introduce another concept from computer programming, object-oriented design (e.g., Montlick, 1999). The idea behind object-oriented design is that prototypical entities, once defined, are then cloned and used by a piece of software as needed.* (Downes 2001 pp 7)

Speaking from an educational perspective, Reigleuth and Nelson (1997) propose that the breaking down into instructional components (learning objects) is akin to the typical practice of instructors when they develop a course or learning sequence. The content and relationships are broken down and the learning strategy and evaluation is then selected for each component. However it is the technological not the educational agenda that dominated the earliest discussions of development, categorisation and location of learning objects. We cannot deny the importance of this aspect, for reusable objects would not find users if the content and form were not able to be effectively defined, described and delivered. More recently and very importantly there has been a cry for pedagogical aspects of learning objects to drive the process of development and definition. (Boyle & Cook 2001, Ip & Morrison 2001) Indeed Ip & Morrison would draw us back to the programming roots of the term learning objects and propose that unt il the contextual rendering of these objects occurs they are not learning objects at tall but digital resources.

The issues that surround the value of the seemingly simple concept of learning objects appear manifold and go directly to the heart of the nat ure of instruction. The actual objects, their granularity, interoperability and reusability and how the learning event/s or exchanges they involve can be fully described, identified and evaluated are topics for hot debate. How small do components need to become to be discrete and reusable? What exactly does it mean for a learning object to be reusable? For whom is it reusable and can it be rendered for all learning contexts and paradigms? How will instructors be able to identify and select the appropriat e learning objects for their instructional context?
Can these learning objects be seen as dynamic and iterative in an evaluation cycle involving their users? We hope to touch on some of these issues and highlight some of the key researchers working through these issues.

Epistemological Ontologies

Traditionally ontology dealt with the area of metaphysics, which defined the fundamental distinct entities to which existence could be ascribed. Within a particular area of interest, such as that of Teaching and Learning Systems, we need to qualify this to allow a plurality of ontologies of which a specific one constitutes a valid domain in its own right. Smith (Smith, 1998) thus distinguishes R-ontology (reality-based ontology) and E-ontology (epistemological ontology). While the first deals in the general meaning of 'being', the second provides the basis of a conceptualisation of a particular domain.

Ontology construction of this kind is now an accepted tool in a number of disciplines. In the field of Geographic Information Systems, for instance, Fonseca and Egenhofer describe one such system thus. *Ontology plays a central role in the definition of all aspects and components of an information system in the so-called ontology-driven information systems. The system presented here uses a container of interoperable geographic objects ... This approach provides a great level of interoperability and allows partial integration of information when completeness is impossible* (Fonseca & Egenhofer, 1999 pp.14). Researchers have described the value of this process, even at an intermediate or tentative stage. Gaede and Stoyan state, *Supposing that universally valid terminology is neither near nor realistic, partial domain as well as pedagogical ontologies ... have already proven fru itful.* (Gaede, & Stoyan, 2001 pp. 535).

Epistemological ontologies form a suitable area for the use of these methodologies. Of particular relevance to learning systems, constructivism offers one such radical approach, which has been characterised as *an epistemology of learning rather than a framework of teaching* (Nunes, McPherson, Rico, 2001). Thus it has been argued that *A constructivist epistemology views knowledge as a construct of individual's understanding. When individuals come together, such as in a learning environment, their construction undergoes continuous revision due to cognitive conflict which occurs as a result of different constructions among individuals.* (Hendriks & Maor, 2001 pp. 732).

Nevertheless, even this social constructivist viewpoint still poses the question of how methodologically a constructivist epistemology can be incorporated in an objective model of learning. One approach to this we could postulate would be to attempt to derive a constructivist epistemological ontology. This would allow the interfacing and inter-relating of different constructivist models into a single coherent working framework. Would this aim violate the underlying principles of constructivism? This need not be the case as the process of ontology derivation itself, as dynamic and subject to progressive development, could be considered within the constructivist framework, as an activity at a meta-level, carried out by constructivist educational practitioners rather than the learners themselves.

Ontology construction can also employ techniques, such as conceptual graphs and topic maps. Futhermore, development environments exist that will allow these in turn to be mapped to HTML/XML representations. For instance, the collaborative environment, Veda (Prata, Paraguacu & Reis, 2001 pp.1512), is described in the following manner. *The conceptual graphs ... provide a form to represent knowledge through the ontology (application domain) and logic (logical first-class). Following its formalism, we can represent graphical form in linear form and create a computational model. This computational model together with the features of hypertext, allows indexing the knowledge in HTML format.* In addition to the techniques discussed earlier for ontology development generally, the process of constructivist ontology construction can draw on a variety of other techniques from various fields. Stutt, for instance, suggests the use of "ontological and other (problem solving) categories from knowledge engineering, a basically constructivist rather than mirroring approach to knowledge and, finally, computational models of and computer support for argumentational structures" (Stutt, 1997). It is an approach similar in principle to this, which could utilise topic map representations to derive learning objects implemented in XML, that we intend to investigate further.

Conceptual Graphs and Topic Maps

Topic Maps: ISO standard (ISO 13250, http://www.y12.doe.gov/sgml/sc34/document/0129.pdf) in its SGML/HyTime-implementation. Final 1.0 version of the XML http://www.topicmaps.org/xtm/1.0/ .

The technology of topic maps is nothing but formalising relationships of concepts using topics, associations and occurrences, in a machine-readable and platform independent format. The connection to the real world and its learning material is maintained by links called "occurrences", which allow for linking out of the abstract topic cloud to files, URLs, or learning objects in a learning environment.

From a technical standpoint, topic maps can be represented using valid XML documents with basically three different sorts of elements: topics, associations and occurrences. A topic is anything the designer of the map wants it to be, mostly the abstract representation of a "thing" or a concept, which is connected to other things via associations. These associations are themselves topics, and an association has roles for the two topics it connects, defining the role each connected topic is playing in the association. With this set of elements it is possible to structure and represent an eontology in an abstract and technologically independent manner. The topic map itself is created while parsing ("reading") the topic map exchange document and building the n-dimensional mesh of topics and associations in the memory of the computer.

When two topics are merged, the result is a single topic whose characteristics are the union of the characteristics of the original topics, with duplicates removed. It is an approach similar in principle to this, which could utilise topic map representations to derive learning objects implemented in XML that system designers need to investigate further. Consider if we chose a given a domain, for instance civil engineering, where it is rather easy to divide the domain into basic concepts (such a concept would be "Newton" – apple falling from tree...). Then it should be possible to create a topic map made out of these concepts and linking associations, thus covering the domain knowledge on an abstract level. The next step is to mediate these concepts through learning objects such as course material or resources (text, animation, movie and audio) which itself is built so that it is basically context-free, modular, reusable in different places. Given those two conditions a learner might 'walk' his/her way not only through predefined paths (defined by teacher for a certain course or lesson), but also leave the path and look via the topic map to adjacent topics, and from there to other learning objects.

XML and Metadata Standards

XML, Extensible Markup Language is a W3C recommendation (not yet a standard), derived from SGML (ISO standard), somewhat similar to HTML, as it is markup, but with freely definable tags.

Metadata is commonly described as being "Data about data", which provides a means by which the multimedia's semantics can be described in a structured fashion for use by various applications. More technically Metadata is standardized information to describe digital information resources (Dorner, 2000 pp. 74). Metadata can be seen as sets of rules and meaning/usage of tags lead to the following specifications: IMS, Dublin Core, LOM, SCORM, and EML. On a higher level Metadata can be viewed as technical/administrative Metadata vs. didactical Metadata http://eml.ou.nl/forum/faq/index.htm#A10.

It is possible to define one's own tags, which allow a parser to know what text between tags (element) *is*. This gives not only the freedom to separate the content from the formatting (big advantage, as we can now reformat according to the *meaning* or *being* of an element), but also the freedom to define things according to our needs. This includes the possibility to set up rules allowing or forbidding the existence of an element at a certain position (e.g. within other elements) using DTDs or schemata a parser can determine the *validity* of a given XML document against a given set of rules. With this, we have a first step towards the computational model mentioned; machine readable content with mark-up allowing for meta-information and meaning.

Holzinger et al (2001), Kassanke et al (2001) and Bick et al (2001) very ably unpack the development and need for educational Metadata and the instructional uses of XML. *Current approaches more or less focus on the representation and structuring of learning contents, e.g. the Learning Material Markup Language (LMML) (Suess, 00). Another good example for the increased significance of XML in CAL is the XML binding for the Instructional Management Systems Project (IMS) Learning Resource Meta-data Information Model, which is based on the IEEE Learning Technology Standards Commitee (LTSC) Learning Object Metadata (LOM) base document (Anderson, Wason, 00). (*Bick et al 2001 pp. 145)

The indexing could occur in a broader Metadata framework using such emerging tools as the Open Archives Metadata Harvesting Protocol, an important new infrastructure component for supporting distributed networked resources. The Protocol is a mechanism that enables data providers to reveal their chosen Metadata, whether it be XML or some other. This approach brings ontological construction into a more comprehensive systems and services architecture (Lynch, August 2001).

What kinds of issues need to be considered pedagogically? The current IMS specifications contain implicit pedagogical models. The absence of a generalized representation of pedagogical models has the potential to lock out other models, and indeed ones that have yet to be developed. This could lead to all kinds of practical problems, especially in terms of interoperability. The EML philosophy is that EML should be capable of a complete description of a course, including the content, the work processes between the actors (learners and staff), and that this description should be independent of the LMS (learning management system) is order to ensure long-term interoperability, sustainability and opportunities for re-use.

Hermeneutic Analysis

Hermeneutics and phenomenology are closely linked and although they share common concerns, they offer different perspectives. Phenomenologists focus on the lived experience of people, and seek out the commonalties and shared meanings, whilst hermeneutics refers to an interpretation of language. Hermeneutics derives from the Greek noun 'hermeneia' which translates as 'interpretation'. Hermeneutics has a dual value in helping educators to understand how learners experience both conceptual change and how they use the new e-learning environments, and hence it has insights to offer in terms of usability testing and evaluation. In this sense hermeneutics can offer a model for pedagogy, to promote active learning, whilst at the same time acting as a research tool for exploring the individual and collaborative learning experience (Rogoff, 1990).

As a research methodology, hermeneutics assumes that meaning making is embedded in the process of dialogue between interpreter and narrator. The hermeneutic circle is a way of articulating and interpreting discourse. Hermeneutic phenomenology is based on the philosophy of Heidegger and Gadamer (van Manen, 1990). Hermeneutic phenomenology is both descriptive and interpretative. It is an attempt to do the impossible, *to construct a full interpretation of some aspect of the life-world, and yet to remain aware that life is always more complex than any explication of meaning can reveal.* (van Manen, 1990 pp.18)

A conception always has two dimensions, one focusing on *what* people experience, i.e. the *content* or the referential aspect, and the other focusing on *how* someone thinks about the specific phenomenon, i.e. the *structural* aspect. (Marton, 1996) According to phenomenography, knowledge is always linked to specific content and can only be described as knowledge about something. This means that knowledge is always provisional and qualitative. To become more knowledgeable in a subject implies a qualitative change to a deeper and more complex understanding of a phenomenon. Marton's work is a key influence in establishing a phenomenographic approach to researching learning and teaching. Knowledge objects can be designed to engage students in deep learning, which promotes real understanding. By students engaging in critiques of existing theories and ideas new knowledge and understandings can arise. (Marton & Booth, 1997)

Phenomenography offers a unique approach to understanding student experiences. The process can uncover the essence of a phenomenon by gathering stories from students engaged with learning objects in an e-learning environment, interpreting those stories and offering implications for practice. It is akin to action research in that the students are not simply subjects of the study, but active participants. The research process creates opportunities for reciprocal learning, metacognitive learning for the student and an awareness of how the e-learning environment is experienced by the researcher.

Hermeneutic analysis can show the development of varying perspectives from which individual learners understand a task. It can also track the development of a joint approach to a collaborative task and can illuminate the process of learning. A fine-grained hermeneutic analysis can provided a framework for 'listening to' what learners can tell us about the appearance of the shared space to individual contributors. It can tell us how individual perspectives are different from one another, and from our own as researchers or as instructional designers. This insight will prove to be vital when evaluating the effectiveness of electronic learning materials designed to foster a social construction of knowledge.

Conclusion

Can hermeneutic analysis be used to evaluate pedagogically based learning objects designed from constructivist epistemological ontologies defined in XML Metadata? It really isn't just a string of highfalutin buzzwords but a question to stimulate thinking about the full cycle of development of learning objects. This paper set out to explore is the nexus of conceptual and theoretical foundations, systems design and current pedagogical frameworks found to be relevant on the road to developing true learning objects. If we can begin by investing the time to construct thick epistemological ontologies and make explicit ontology/ies through representational tools like topic maps, we can begin to answer the detractors who see learning object development agenda as being stolen by programming considerations. These topic maps in turn can be translated into the rich data carriers and renderings possible with XML and Metadata. The representation of the domain in related and merged topic maps has the potential to allow learners to articulate, direct, share, relate and critique the learning experience from their personal perspective. The hermeneutic analysis discussed here gives designers and instructors the opportunity to do that listening to learners. In terms of usability testing this approach offers insights into how learning is experienced, not simply how the instructional designer conceptualises it. The learning process is not separate from specific learning content and context. The learning experience is a composite of the learner, the domain and the e-learning environment.

References

Bereiter, C., & Scardamalia, M. (1993). *Surpassing Ourselves-an inquiry into the nature and implications of expertise*. Chicago, Illinois, USA: Open Court.

Bick, M., Pawlowski, J.M. & Veith, P. (2001). The Essen Learning Model - A Step Towards a Representation of Learning Objectives. In C. Montgomerie, & J. Viteli (Eds.). *Proceedings of ED-MEDIA 2001: World Conference on Educational Multimedia, Hypermedia & Telecommunications*. Tampere, Finland, June 25-30, 2001. Norfolk, VA: Association for the Advancement of Computing in Education (AACE) ISBN: 1-880094-42-8. pp. 145-150

Boyle, T. & Cook, J. (2001) Towards a pedagogically sound basis for learning object portability and re-use. In G. Kennedy, M. Keppell, C. McNaught & T. Petrovic (Eds), *Meeting at the crossroads.* Proceedings of the 18th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (pp. 101-109). Melbourne: Biological Multimedia Unit, The University of Melbourne.

Clifford A. Lynch (2001), "Metadata Harvesting and the Open Archives Initiative," *ARL: A Bimonthly Report on Research Library Issues and Actions 217* (August 2001).

Dorner, Dan (2000): Cataloging in the 21st century — part 2: digitization and information standards. *Library Collections, Acquisitions & Technical Services*, 24, 73–87.

Downes, S. (2001) Learning Objects: Resources For Distance Education Worldwide International Review of Research in Open and Distance Learning (2001) ISSN: 1492-3831 Available: [Accessed December 20, 2001]

Ekeblad, E., & Lindstrom, B. (10/12/2001). *Collaboration as Pedagogy, Collaboration as Window*. Available: http:/www-cscl95.indiana.edu/cscl95/ekeblad.html [Accessed December 20, 2001]

Fonseca, F., Egenhofer, M.J. (1999) Ontology-Driven Geographic Information Systems, *7th ACM Symposium on Advances in Geographic Information Systems, Kansas City, MO, 1999, p14-19*

Gaede, B., Stoyan, H. (2001) A Generator and a Meta Specification Language for Courseware, *Proceedings of Ed-Media 2001, p533-539*

Hendriks, V., Maor, D. (2001) Understanding the Quality of Students' Interactions through Computer Conferencing in Higher Education from the Social Constructivist Perspective, *Proceedings of Ed-Media 2001, p730-735*

Holzinger, A., Kleinberger, T. & Mueller, P. (2001) Multimedia Learning Systems based on IEEE Learning Object Metadata (LOM) In C. Montgomerie, & J. Viteli (Eds.). *Proceedings of ED-MEDIA 2001: World Conference on Educational Multimedia, Hypermedia & Telecommunications*. Tampere, Finland, June 25-30, 2001. Norfolk, VA: Association for the Advancement of Computing in Education (AACE) ISBN: 1-880094-42-8. pp. 772-777

Ip, A. & Morrison, I., (2000). Learning objects in different pedagogical paradigms In G. Kennedy, M. Keppell, C. McNaught & T. Petrovic (Eds), *Meeting at the crossroads*. Proceedings of the 18th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (pp. 289-298). Melbourne: Biological Multimedia Unit, The University of Melbourne.

Kassanke, S., El-Saddik, A. & Steinaker, A. (2001) Learning Objects Metadata and Tools in the Area of Operations Research. In C. Montgomerie, & J. Viteli (Eds.). *Proceedings of ED-MEDIA 2001: World Conference on Educational Multimedia, Hypermedia & Telecommunications*. Tampere, Finland, June 25-30, 2001. Norfolk, VA: Association for the Advancement of Computing in Education (AACE) ISBN: 1-880094-42-8. pp. 202-206

Marton, F. (1996). Cognosco ergo sum- Reflections on reflections. In G. a. H. Dall'Alba, B. (Ed.), *Reflections on Phenomenography. Towards a Methodology?* (Vol. 109, pp. pp 163-187). Goteborg: Goteborg Studies in Educational Science.

Marton, F., & Booth, S. (1997). *Learning and awareness*: Mahwah, N.J: Erlbaum.

Nunes, J.M.B., McPherson, M., Rico, M. (2001) Constructivist Instructional Design and Development of a Networked Learning Skills (NICLS) Module for Continuing Professional Education Distance Learning. *Proceedings of Ed-Media 2001, p86-91*

Prata, D.N, Paraguacu, F., Reis, A. (2001) A Collaborative Environment for Visual Representation of the Knowledge on the Web – Veda. *Proceedings of Ed-Media 2001, p1512-1513*

Smith, B. (1998) An Introduction to Ontology. In D. Pequet, B. Smith, B. Brogaard (Ed.), *The Ontology of Fields*

Reigleuth, C. M. & Nelson, L. M. (1997). A new paradigm of ISD? In R. C. Branch & B.B. Minor (Eds.), *Educational media and technology yearbook* (Vol. 22, pp. 24-35). Englewood, CO: Libraries Unlimited.

Rogoff, B. (1990). *Apprenticeship in thinking; Cognitive development in social context*. New York: Oxford University Press.

Stutt, A. (1997) Knowledge Engineering Ontologies, Constructivist Epistemology, Computer Rhetoric: A Trivium for the Knowledge Age, *Proceedings of Ed-Media 1997, p1914-1919*

van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy*. New York: State University of New York Press.

Vygotsky, L. S. (1978). *Mind in Society*. Cambridge MA: Harvard University Press.

NOTICE

Reproduction Basis

X	This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.
	This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").