Authoring Pedagogically Meaningful Content for Networked Learning

Working Group 3.3

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Abstract This professional group set out to approach this topic from three perspectives: from underlying pedagogical principles, from design models for the designer, and from the tools and platforms that the designer had available for the implementation. The group as a whole concluded that although the design process should be theory-informed, there is no one theory, no one process model, or no one implementation platform inherently better than others. Finally, the group identified several qualities for the design process and implementation tools.

1. BACKGROUND

Networked learning environments are widely considered to be a sophisticated and effective way to distribute distance learning. They may replace not just traditional modes of distance education, but also courses previously offered primarily face to face. The importance of network-based learning has dramatically increased as life-long learning and learning at the workplace has become as important as formal education within school

institutions. This places new demands for the design of networked learning environments.

However, research has shown that a much instructional design practice has evolved as a procedural and media-production craft rather than a process grounded in pedagogical theories. This trend seems to continue to be the case in networked learning. Many of the Internet-based learning environments have been designed and implemented ignoring well-known pedagogical approaches facilitating effective teaching and learning.

Lack of appropriate tools for a non-professional in computing was long a major problem for the design of Internet-based learning environments. Now, there is commercially available software to support the implementation of online courses, many in the public domain. Some of these are so called integrated authoring tools that provide a large suite of pre-programmed facilities for the designer to choose from. In most cases, however, while such software provides support for the teaching process, that is, for the administration of the students and the courses, what is missing is the support for designing pedagogically meaningful content. The content may be created also using standard HTML Editors.

In this professional group we discussed the process of authoring online educational materials in an attempt to outline methods for designing and implementing pedagogically meaningful content for networked learning environments.

2. GROUP WORK

The group approached the topic from three perspectives. The first sub-group discussed the underlying theoretical principles: what does it mean if we have 'pedagogically meaningful learning content'? And what does this implicate for the design and implementation process? The second sub-group considered the issue of detailed design models for the preparation of instructional materials. Our third sub-group dealt with the implementation issues: the languages, tools and platforms that could be used in crafting the learning content onto the Web. The work of each sub-group was intertwined with the others, so after summing up and consolidating a common view on each issue emerged.

3. PEDAGOGICAL ISSUES AND BEST PRACTISES

We discussed best practices and the notion of 'pedagogically meaningful content'. Four important issues arose in the discussions.

The first was that all *learners* bring differing experiences, knowledge, skills and understanding to potential learning situations. They make sense of the things they learn through the filter of their current understandings of the world. They also have differing cognitive skills, learning styles, and focus of control preferences, i.e., some students learn best when the learning is scaffolded in a very logical and sequential manner and others learn best when they can have more control over how the information is accessed and engaged with.

An appropriate pedagogy provides multiple entry points to engage and challenge diverse groups of learners. The interactive didactic program with multiple entry-point-access in course A, must ensure the acquisition of common knowledge and skills (a shared repertoire) needed to create collaborative learning process in a course B, based on course A. A goal-free evaluation of course A must be developed to spot content-related knowledge and skills presupposed in course B. A theory of educative institutional frame is relevant to a pedagogical theory of learning-process. The institution must specify and implement its requirements for pedagogical progression in learning.

The second issue was that we need a *meta-pedagogical theoretical frame* incorporating the qualities of both the 'objectivist' and the 'constructivist' approach. Opposing objectivists and constructivists in a negative-positive polarised schema of summed combinations of qualities within a continuum is at its best a pedagogically simplified illustration. However, taken at face-value it leads, through its awe-inspiring terminology and authoritativeness, to a pseudo-theoretical discussion that reveals partisan intentions, thus biasing the debate on the relation between learning theory and best practices among experienced teachers, forcing them either to corral or bandwagon. Summing qualities in a non-ordered model illustrates the danger of proliferating relations that invalidates the model's controllability and applicability. The use of 'continuum' as a term illustrates the danger of an approximate terminology in the pedagogical discourse that might alienate an important part of the target group with most experience of systematic approach and logical analysis, i.e. the teachers of exact sciences, that should be able to integrate ICT in learning/teaching. Heuristic approaches functional to the specific strategy of introducing new (ICT-adequate) parameters in education should not overshadow the question of creating a theory of pedagogical best practices.

The third crucial issue is *interactivity*. All software is interactive at some level. Pedagogically meaningful software must be interactive at the very highest level, and in many different respects. Current technology can offer a remarkable degree of interactivity, but actually providing such support to learners, and assisting them in learning to avail themselves of it, makes

preparation of highly interactive materials vastly more complicated and difficult than it would be otherwise. Depending always on the particular discipline, subject and pedagogical approach, the following types of interactive support should be more or less routinely available.

- Intelligent tutor emulation, with content reflecting the particular student's current status and apparent competence level
- Complete Internet access
- Access to peers, synchronous or asynchronous as practical
- Measures of both progress made and work remaining, both on the current topic or project and in the overall course or program
- Statements of, and/or relevant questions about, pertinent general principles, to help the student comprehend the big picture even when concentrating mainly on details
- Samples of good work of the current sort, correctly solved problems of the current general type, similar enough to be helpful without admitting direct copying
- Facilities for editing, reviewing, retracing and revising earlier work
- Access to appropriate tools, such as spelling and grammar checkers and calculators
- Access to low level help, such as keyboard and mouse practice, tutorials on how to save current work, and many others.

Students often do not 'discover' available interactive support facilities on their own. Pedagogically effective software should monitor each student's use of the interactive support facilities, and then help the student who appears unaware of their availability to learn to use them. The group were not aware of any Internet-based or computer-based instructional materials which can be cited 'fully interactive'. Programs must be designed in a way that creates a possibility to choose different ways to learn. For example, programs can use 3D-virtual reality simulated environments that students can be part of and involved in.

The fourth important issue is *collaboration*. Didactic principles for collaboration in learning communities are mutual engagement, shared repertoire and activity. These principles are a way to create efficient learning, to incorporate the principles of learning communities in all aspects and dimension of the design of computer supported collaborative learning. This includes the choice and design of technology, learning-/teaching-manner and the institutional frame. A design based on these principles can intensify the collaboration, thereby engaging and motivating the student to make and maintain a learning community.

4. PROCESS MODELS AND EXISTING METHODS

We discussed the process models and existing methods for instructional design. First, we identified a set of five assumptions.

1. Pedagogically meaningful knowledge is best achieved by a constructivist approach in most situations.
2. In designing an instructional design model to author meaningful content in a networked environment, we should not tie ourselves down to the present realities of lockstep-classes and standardised testing. We should assume that learning will be more individualised and asynchronous, and less place-bound.
3. Instructional design in the broadest sense needs to include the notion of students as designers of their own learning.
4. The network brings information to learners and can help to manage multiple paths to multiple learning goals.
5. A truly effective instructional design system works at the level of whole curricula, cutting across multiple disciplines and over several years of a learner's life.

To illustrate our view on instructional design, we outlined the following principles. The design process should begin with a tentative set of learning goals that are subject to change. The instructional design process has a sequence, but each step can be revisited and the results of each step are subject to change. The process should be collaborative, with learners as active participants and co-designers. Instructional design skills are best practiced in context, and the best designers are situated and experienced in that context and content. A good learning environment is anchored in an open-ended, constructivist approach and punctuated by direct instruction when appropriate. The core of a good lesson is an open-ended problem situation with direct instruction provided for just-in-time learning. Assessment of student learning should be based on a blend of quantitative and qualitative data with some emphasis on the latter.

We considered the WebQuest approach as one expression of the principles that are key to good instructional design. We also discussed the models presented by Willis, Jonassen, Dick & Carey and ones described by McManus. We concluded none of these fulfilled our criteria for a dynamic, holistic, forward-oriented instructional design process. The creation of an alternative instructional design model however was not possible during the work period of this professional group. We also recognised the tensions involved in providing in a model, a necessarily simplified description of a complex, recursive process.

Thus we expect networked learning to play a major, and increasing, role as the learner will influence a growing part of the instructional design process, and networking will be a key instrument of this influence.

5. LANGUAGES, TOOLS AND PLATFORMS

We discussed learning management systems, existing languages and platforms for authoring learning content. The discussion led us to define the concept of learning objects. Finally, we discussed XML as a future solution for standardising the learning content. When discussing general requirements of tools or platforms in educational use, we cannot avoid the fact that the needs of educational systems differ greatly. For example, in schools usage focuses on lessons, not in the time outside school; in universities administrative support plays a greater role. So, specific requirements for learning environments cannot be given.

The most useful recommendation might arise from modularity. When platforms are built from independent modules, whose interface is defined, authors can build the platform according to their needs, using the best platform and authoring tools. Learning Management Systems are practical for delivering content for networked learning, but most important is the quality of the content. Content should be developed to take advantage of the potentials of technology. Materials should differ from the traditional way of producing books and use the possibilities offered by the technology, for example hypermedia and multimedia. A promising solution to authoring learning materials is the notion of learning objects. When using learning objects, the learning material can be seen as a collection of the best possible objects. It is not necessary that authors of the material write all the material themselves. The objects can be obtained or bought from experts, who are specialised to certain areas.

The learning objects can be seen as normal objects, labelled with certain well defined inputs, it can do, execute or play one of the well defined tasks and finally it gives a well defined output i.e. the learning object should have well defined interfaces. With such a system we can separate the course and the content and one learning object can be used in many courses. For example, ideas about triangulation (defining a point in 3D-space) can be used in a mathematics course, in a geographic course, and particularly today in the course (learning material) on mobile networks as the background for localisation services.

The learning object can be designed and implemented by using any tool or language. The learning material that is calling the learning object is responsible for ensuring that the system can run (present) the object. For

example, if the learning material is web-based and the learning object is an executable file, the learning material should decide how the object is used or whether it is used at all. This gives the experts and content producers more space to produce learning objects with the most suitable tools and with the most suitable methods. This also might raise the quality of learning materials, because the learning material can be collected from the set of the learning objects and one bad object can be easily replaced with another.

To be effective, the communication of the learning objects must be defined well, and standards are needed. When calling the object, the material should know something about the object. For example there could be two types of objects: note and tasks. Note can be a picture, animation, text, sound or whatever material that do not give evaluation or other feedback about its user. Task relates feedback to material, the task can be a test or a game, but in every case it gives some evaluation about user.

It is not always realistic or possible that the learning material is produced by the individual teacher. In those cases we suggest that support teams are established at local level to help teachers produce and publish their material. The support teams should be subsidised through public financing and grants from private companies and funds.

The improving role played by XML technology in the design and development of educational material and environments, is mainly due to its essential features: XML is a meta-language through which one can define structured or semi-structured information; de-coupling content by its many possible representations; so allowing the creation of, reusable content and its personalisation independently from platform and proprietary tools constraints (it is a standard). Though these are features that apply to other application sectors, let's examine three possible scenarios into which XML reveals its usefulness for designing of pedagogically meaningful content.

The author/teacher/expert, is free to write the educational material with their preferred editor and then through the application of simple tools transform it into XML format. One further transformation step will permit the addition of other information such as for example information relating to students' profiles or layout style. Finally the use of different stylesheets will allow the publishing of the content in the most suitable format, for example html to deliver the content via the Web or pdf to print it.

XML allows us to realise learning paths (courses), based on a possibly wide collection of educational objects, which are structured and organised with respect to the actual pedagogical needs. In an XML file it is possible to identify: which learning objects are involved in a learning path; the ways in which they are organised; the relationships that exists between them; and the particular target to which they are devoted. Through this, it is possible to

automatically obtain 'tools' such as index, guided maps, navigation buttons, which will allow instant delivery of a complete course to the web.

Through the use of XML-languages (such as MathML, OpenMath), and the emerging family of related graphical tools it is possible to realise and integrate information of different domains into one educational object.

6. CONCLUSIONS

We studied the process of authoring pedagogically meaningful online educational materials. From the pedagogical view-point the four important factors are heterogeneous students, interactivity, collaboration and an adaptation of the best of different learning theories. It is important that the design is informed and grounded by theory. There are many ways to ground design principles, none of which is inherently better than other approaches.

Pedagogically meaningful material must be highly interactive and support content and constructive student collaboration. Pedagogically meaningful materials should provide multiple entry points to engage and challenge diverse groups of learners. Programs must be designed in flexible ways for learners to choose different ways to interact with the materials. The instructional design system should be designed to support the authoring of meaningful pedagogical content in a networked environment. The core of an environment is open-ended, flexible problems with just-in-time instruction. A good learning management system is important for delivering content for network learning, and the quality of the content is essential. The role of standardisation and standardised languages, such as XML, becomes more important when learning systems become more modular. Standardisation would be one milestone when making more intelligent and pedagogically meaningful learning systems.

We decided to continue the work initiated in this professional group. An email discussion list will be established and this topic will be a stream at the IFIP Open Working Conference, eTrain 2003: E-Training Practices for Professional Organisations (7.-11.7.2003, Pori, Finland).