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From the editor..

Welcome to the January 2004 issue of Learning Technology.

This issue contains special section on "Learning Communities & Web Service Technologies", guest edited by Prof. Demetrios Sampson, University of Piraeus and CERTH, Greece, and assisted by Kostas Kastradas University of Piraeus, Greece.

The IEEE International Conference on Advanced Learning Technologies (ICALT2004), Joensuu Finland (August 30 - September 1, 2004) is coming out as a very high quality conference. The proceedings of the ICALT 2004 will be published by IEEE Computer Society Press. The website of the conference (http://lttf.ieee.org/icalt2004/) contains details of submission procedure. The deadline for submission is February 13, 2004.

You are also welcome to complete the FREE MEMBERSHIP FORM for Technical Committee on Learning Technology. Please complete the form at: http://lttf.ieee.org/join.htm.

Besides, if you are involved in research and/or implementation of any aspect of advanced learning technologies, I invite you to contribute your own work in progress, project reports, case studies, and events announcements in this newsletter. For more details, please refer author guidelines at http://lttf.ieee.org/learn_tech/authors.html.

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4th IEEE International Conference on Advanced Learning Technologies

(ICALT 2004)
August 30 - September 1, 2004
Joensuu, Finland
http://lttf.ieee.org/icalt2004/

Important Dates

February 13, 2004	paper submission
April 19, 2004	notification of acceptance
May 24, 2004	final camera-ready manuscript
May 31, 2004	author registration deadline

Proceedings

All accepted Full and Short Papers and Poster Extended Summaries, will appear in a single volume to be published by the IEEE Computer Society Press. Extended versions of selected papers will be invited for a Special Issue of the Educational Technology & Society (ISSN 1436-4522) journal.

Topics of Interest

Adaptivity in Learning Systems
Advanced uses of Multimedia and Hypermedia
Architecture of Context Aware Learning Technology Systems
Artificial Intelligence Tools for Contextual Learning
Building Learning Communities
Concretizing Technologies (e.g. Robotics) in Learning
Educational Modelling Languages
Educational Paradigms
Information Retrieval and Visualization Methods for Learning
Instructional Design Theories
Interactive Learning Systems
Learning Objects for Personalised Learning
Media for Learning in Multicultural Settings
Metadata for Learning Resources
Mobile Learning Applications
Participatory Simulations
Pedagogical and Organisational Frameworks
Peer-to-Peer Learning Applications
Socially Intelligent Agents
Technology-Facilitated Learning in Complex Domains
Virtual Spaces for Learning Communities

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Paper Submissions

Please follow the submission procedure given at the conference website:
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Guest Editorial

Special Theme on

Learning Communities & Web Service Technologies

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The use of Web services on the World Wide Web is expanding rapidly as the need for application-to-application communication and interoperability grows. These services provide a standard means of communication among different software applications involved in presenting dynamic context-driven information to the user. On the other hand, building a learning community is a collaborative process that necessitates an artful mix of direction and facilitation requiring more than just technology. Collaborative learning communities go beyond just online discussions - they represent purposeful groups focused on advancing knowledge, elevating personal and organizational effectiveness, and generating tangible results. Beyond traditional features like online discussions, instant messaging, document management, and searchable member profiles, the next generation web-based learning community environments should provide powerful tools for facilitating meaningful and productive interactions between members. Recently, there are a number of efforts aiming to investigate whether web services can provide the essential infrastructure for the design and development of next generation learning communities supporting environments. The Special Theme of this Learning Technology Newsletter issue aims to collect early research opinions and development reports on the application of Web Service Technologies in the area of Online Learning Communities.

In the aricle entitled "*A Framework Based on Web Services Composition for the Adaptability of Complex and Dynamic Learning Processes*", Jorge Torres, Juan Manuel Dodero and Carmen Padron present a framework for the dynamic composition of learning processes. The framework uses basic Web Services specification languages (such as SOAP, WSDL, UDDI) for the description of learning objects as Web Services and their publication in UDDI Repositories, as well as Web Services Composition Languages (such as BPEL4WS, WSCI, WS-T, WS-C) for the composition of learning objects into learning processes. Through this framework web based learning environments can be built that provide personalized managing and web-based deployment of learning courses.

Douglas Siviter, in "*Adopting and Adapting Enterprise Technologies for Use in Education*" presents a number of research issues that arise from various educational scenarios of the application of Web Services in the area of Education, such as the adoption of Web Service interfaces from learning objects, the use of Web Services Composition Languages (such as BPEL4WS) on modeling educational processes and the effects of Web Services in pattern-oriented approaches for implementing integrated eLearning technologies.

In "*Learning object repositories as contract-based Web Services*", Salvador Sanchez, Javier Parra, Oscar Sanjuan and Miguel A. Sicilia discuss an architecture that combines Web Service and Agent Technologies for online dynamic course composition, based on learner requirements.

The following two articles present examples of how Web Services can be applied in order to extend the functionalities of existing eLearning applications. Stefan Apelt in his paper "*Using Web Services to extend an application to meet new requirements*" adds a web service interface in a current authoring tool thus allowing heterogeneous applications and different devices to interact with this environment. Furthermore, in "*Using Web Services to Enhance Efficiency, Maintainability and Error Handling Across Multiple Instances of Online Collaborative Communities*" Edmund Danyal, Mark Luetzelschwab and Willie Adams propose a five-tier model (on top of which the Web Services Layer exist) for the delivery of a 'Discussion Forum' application as a service to different online communities.

In the next group of articles the reader can find Juha Puustjärvi's' article, entitled "*ONES – One Stop e-Learning Portal*", where the author proposes an architecture, based on Web Services, that facilitates integrated access to different virtual universities and provides efficient search on learning objects. In "*Free-Open Source Learning Community and Web-Based Technologies*" S. K. Sowe, A. Karoulis, I. Stamelos and G.L. Bleris study how Web Services are applied in the context of a Free Open Source Learning Community. Finally, in "*If Content is King, Context is God! Secondary Usage Metadata & Resources in Supporting Web Services for Learning Communities*" John Casey presents the discussions, that were made within an R&D Project, on the services that a learning object repository should provide to a learning community.

The final group of articles gives emphasis on discussions around the area of Online Learning Communities. Robert Luke, Devon Mallory and Lynda Atack in "*Constructing Context-Based E-Learning to Support Telehomecare Communities of Practice*", present an overview of work in progress that is developing metadata applications in conjunction with collaborative online learning models. In "*Evolving a Community for Evolving Learners*", Jonah Benton and Elizabeth Sklar present a web based environment that supports interactive, real-time collaborative educational activities for a community of human learners and intelligent software agents. Muhammad K. Betz in "*Learning Teams in Online Courses*" deals with the use of Learning Teams as an approach for team-based work in online courses, while Iro Voulgari in "*Multiplayer Games and Learning Communities*" makes a study on whether a learning community can be developed through multi-player gaming. In "*Symbolic Interactions in a Virtual Learning Community: Understanding the Creation of Shared Meanings in a Mediated Environment*", Robert Sanders discusses the issue of collaboration in a technology-mediated environment. Finally, Michael Castaneda, based on an empirical approach, in "*Developing an On-Line Learning Community: Four Essential Guidelines*" presents four basic guidelines for the successful development of Online Learning Communities.

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A Framework Based on Web Services Composition for the Adaptability of Complex and Dynamic Learning Processes

Educational models, as well as business, are immersed in a globalized environment of constant knowledge evolution and a permanent technological development. This recommends a new vision and a new learning model to be able to face these challenges.

New educational models are focused on the participative role of the learner and her learning process in the development of knowledge, abilities, values, and in the personalization of the learning process based on the characteristics of the learner (e.g. her cognitive styles, previous knowledge and expertise, motivation, self-esteem, and social abilities) [15].

For the implementation of these models, it is necessary to include strategies in the learning process, based upon didactic techniques, ranging from simpler ones like exposition to the more complex like the Case-Based Method (CMC) [7], Problem-Based Learning (PBL) [2], Collaborative Learning (CL) [3], or Project Oriented Learning (POL) [9], among others. This form of defining the learning process allows the learner to acquire a deep, excellent and up-to-date knowledge, to participate in the direction of her learning, to develop personal qualities, to work in a collaborative form and to use the technology suitably.

Learning Management Systems (LMS) are key tools to support these educational models, which favor the active learning focusing on the learner, improve relations between instructors and learners, foment the responsibility, improve the handling of time and space, offer equality of opportunities for learners, and facilitate the internationalization of the education.

Although typical LMS like those from Blackboard, Lotus, WebCT or ClaroLine, currently incorporate learning objects standards defined by LTSC (Learning Technology Standards Committee), IMS (Instructional Management Systems), and ADL (Advanced Distributed Learning Network), their efficiency in the implementation of new educational models in a specific learning process presents some drawbacks (e.g. low adaptability of the learning process during its execution, implementation of basic learning objects, minimal reusability of learning objects, low integration with heterogeneous systems (which are typically closed environments), required technical effort for the management of contents, low scalability, and limited distribution.

We believe that LMS should evolve towards integrating systems of distributed learning objects with decentralized execution and integration with heterogeneous applications. These can make possible to implement highly specialized learning objects in diverse environments, as well as to reuse them learning objects from inherited systems. Besides, we think that the notion of a centralized repository of learning objects should change onto distributed communities of learning objects.

Integration of the Learning Processes

The learning process is integrated in a framework that includes a set of learning objects, which are perfectly defined, distributed, and which can be retrieved to incorporate them to the process in a dynamic way. These objects provide to the learning process with excellent information to make a dynamic reconfiguration of an instance of the process. This means that the process is adaptive and reuses learning objects that are distributed.

From the instructional point of view, each one of the learning processes will be able to integrate instructional learning objects, either basic ones (e.g. lesson) or more complex (e.g. collaborative development of a project, in which will be necessary to incorporate other simpler objects), as depicted in Figure 1.

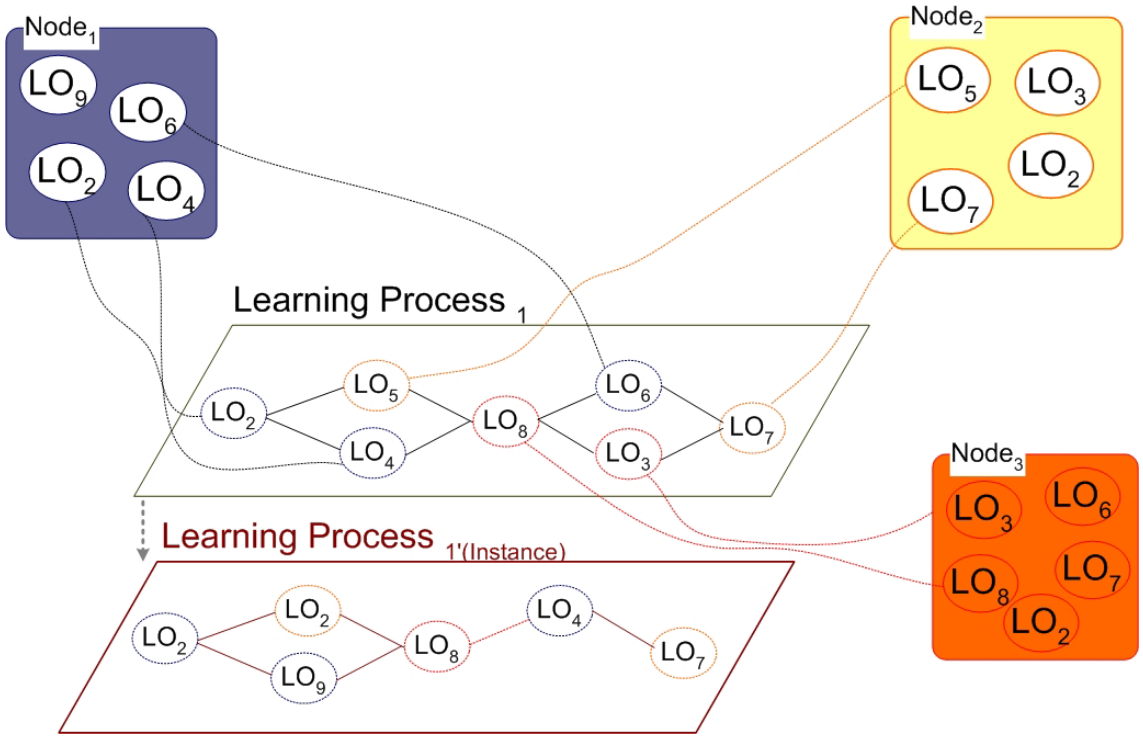

Figure 1. Integration of the Learning Processes

In order to facilitate the integration of objects within the learning process, interoperability is needed in two dimensions: (1) in *the instructional domain*, where LTSC, IMS, ADL and other standards provide definitions of learning objects and their integration issues; and (2) *in the technological domain*, where we can count on software architectures that allow the integration and implementation of learning objects in distributed, heterogeneous and decentralized systems. This interoperability can be attained by means of architectures based on Web Services.

Why Web Services

Web Services, as defined by the Word Wide Web Consortium (W3C), are self-contained applications, whose XML-based interface defines a collection of operations accessible through the network, independently of the technology used to implement them [10]. They are standards to improve the interoperability, reliability, security, adaptability, and extensibility of the Web to integrate applications.

Web Services architectures require a set of modular, layered, perfectly defined and correlated technologies that allow service implementations. Among others, two major groups can be highlighted:

- *Architectures for basic services:* they use standards like SOAP (Simple Object Access Protocol) [8] as a form of exchanging information, WSDL (Web Services Description Language) [13] as the language to describe them, and UDDI (Universal Description and Integration) for publication and search. [4].

- *Architectures for services composition:* they consist of basic services supported by coordination mechanisms. They use standards required by the basic services to be integrated and coordinated, like BPEL4WS (Business Process Execution Language for Web Services) [1], WSCI (Web Service Choreography Interface) [12], WS-T (Web Services Transaction) [14], and WS-C (Web Services Coordination) [11], among others.

Our framework is based on two elements of construction: (1) The *Learning Web Services*, supported by a basic Web Service architecture, which allows to create, define and publish learning objects that encapsulate different learning processes; and (2) *Learning Web Services Composition*, supported by an architecture for services composition that allows to look for, integrate, execute and redefine the learning processes.

A Learning Process Framework based on Web Services

The learning processes framework is defined upon a web services infrastructure, and it consists of the cyclic stages depicted in Figure 2.

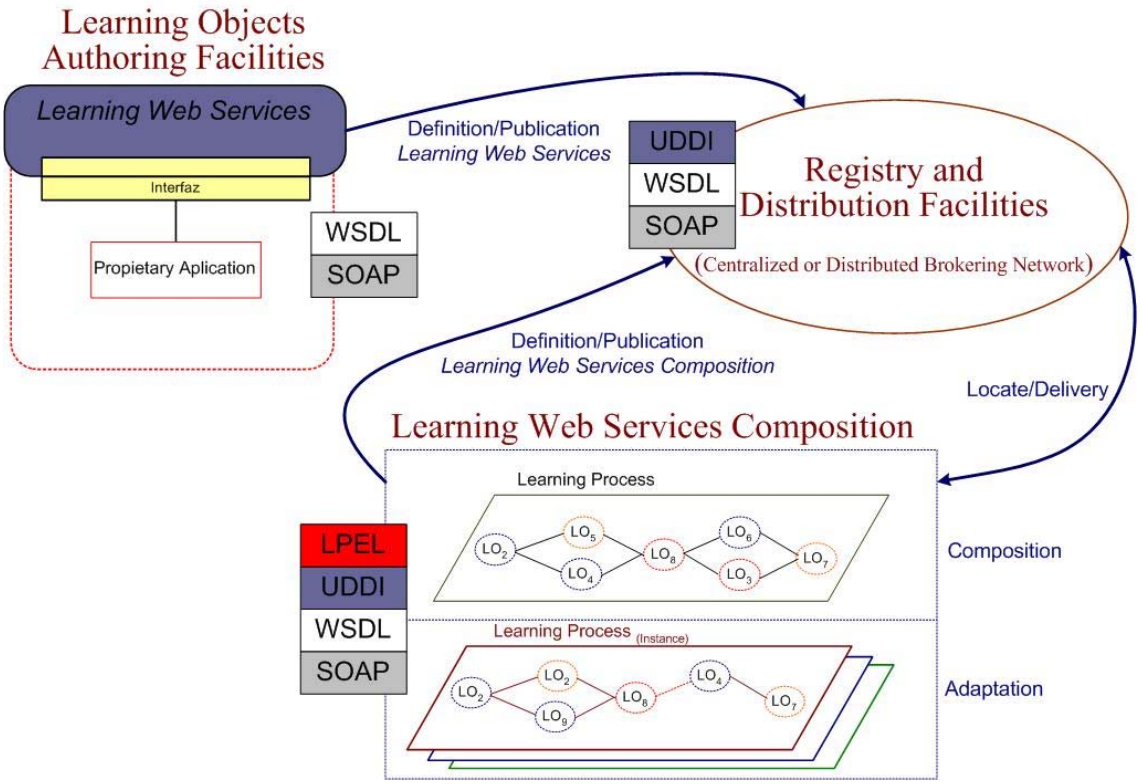

Figure 2. Learning Processes Framework based on Web Services

- *Learning objects authoring facilities*: The operation in the framework begins with a set of tools and applications for learning objects authoring and description. Since learning objects are reusable information units that can be used during technology-supported learning processes, that set of facilities comprise content authoring tools, but also, and specially, any application that facilitates the didactic definition of such learning processes, or which adds relevant information for their realization (v.g. any historic registry of learners that store their performance or cognitive capabilities). We refer to this kind of learning objects as *learning web services*.

- *Registry and distribution facilities:* The next set of services enable the publication and registry of learning objects produced in the previous stage, as well as to locate and delivery other objects according to the needs of the final, composite learning process to be defined. Registry will include the deposit of WSDL-based descriptions for learning web services, either in an UDDI server-based centralized manner, or by means of a distributed brokering network that facilitates the push-style distribution of WSDL described records among heterogeneous systems for which those learning web services can be interesting.

- *Learning web services composition:* The core stage is the composition of learning web services and their adaptation to the needs of a learner or group of learners. Such a composition is carried out by retrieving previously registered objects, combining and describing that combination by web services composition languages like BPEL4WS, WSCI, WS-T and WS-C. Once composed and packaged as learning objects, these composite processes can be executed and then instantiated and adapted to the learner's particular needs. These adaptations can be realized, either by predefined rules implemented into the process description and driven by the learner behavior, or in a supervised manner. In the later case, the instructional designer can return to the composition tools to adapt the process.

The process loop closes with the feedback to the registry repository with the learning web services that were developed and composed in the composition stage. Such composite learning web services can be also available at the same level that the simpler objects from which they were defined.

How to Build up Learning Communities

Based on the learning web services framework, a web-based learning infrastructure can be built up to make possible the personalized managing and web-based deployment of didactic materials. The framework can support per se any collaborative and distributed learning process [6], as well as the generation of content-based communities.

The multi-fold, collaborative perspectives of the learning design process (the instructional designer's point of view, the learner's demands, the content authoring view, etc.) that represent major parts of the learning process cycle can be easily deployed by the framework facilities. On the other side, the social, collaborative nature of the learning process [5], with different roles of its actors (content providers, designers, tutors, pedagogical advisors and students) gives sense to a content-driven organization of work, arranged by communities of interest. The registry and distribution facilities are used to generate those learning web services-based communities.

Conclusions

Web services standards and related architectures can facilitate the integration of distributed, heterogeneous learning services and systems. We propose a step forward to integrate learning objects in an LMS, guided by the business process integration approach, by means of a web services-based framework and related standards. Nevertheless, we think that learning processes are rather more complex than business processes —for which web services standards are actually prepared—. Therefore, some work is still to be done to adapt, for instance, BPEL4WS and related standards to develop future Learning Processes Execution Languages (LPEL).

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Adopting and Adapting Enterprise Technologies for Use in Education

Introduction

Our research group focuses on analysis, specification and practical development of educational resources and collaborative educational processes supported by educational and enterprise technologies. The research is underpinned by a determined effort to systematically adopt and adapt enterprise technologies for educational use.

Using Figure 1 as a figurative impression of our current research context and focus, this short paper provides just the briefest bullet-point tour of some aspects of our research projects and then indicates some ways that Web services are involved.

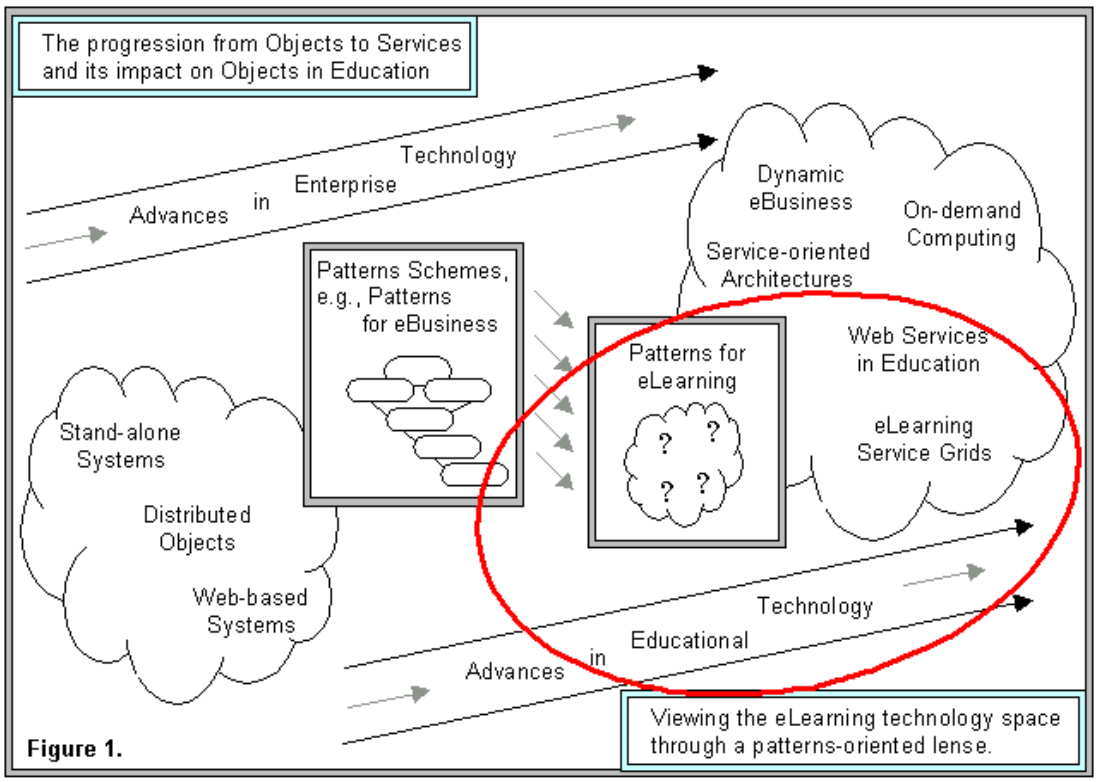

Figure 1.

Context and Observations

- **eLearning as a spectrum of activities**

We see the term 'eLearning' as describing a spectrum of activities ranging from 'eLearning:Administration' to 'eLearning:Educational Practices'. Similar distinctions are noted by various authors, e.g., [1, 2]

- **eLearning technologies – lack of integration**

Technologies to support the whole spectrum of eLearning activities are historically already lacking in integration. i.e., there is typically poor integration between eBusiness technologies that support eLearning:Administration and teaching and learning technologies that support eLearning:Educational Practices.

Advances in emerging enterprise technologies are significantly faster than advances in educational technologies and this trend contributes both opportunities and challenges to achieving the integration mentioned above.

- **Patterns for eLearning**

We favour pattern-oriented approaches for clarifying the complexities of eLearning scenarios. We hold the assumption that integration across the eLearning spectrum can be usefully described within 'Patterns for eLearning' schemes and that the pattern-oriented descriptions can assist in implementing integrated eLearning technology.

Initiatives in several disciplines have extolled the virtues of pattern-oriented approaches and several of these initiatives can contribute insights to patterns for eLearning. So, for example, while looking at eLearning:Administration we can find useful insights from the Patterns for eBusiness initiative [3]. At the other end of the eLearning spectrum, while looking at eLearning:Educational Practices, we can find useful insights from projects like [4, 5]. There are many other examples of patterns initiatives that can be fitted into the eLearning spectrum including for example Patterns for Interaction [6], Patterns for Learning Management Systems [7, 8], Patterns for Software Design, etc. A patterns approach encourages the re-use of successful solutions and in this context leads to questions like "can developments of collaborative educational processes be usefully informed by comparisons with collaborative patterns previously identified within eBusiness processes?".

Web Services in Education

- **The impact of Web services on patterns schemes**

We are interested in seeing the effects that Web services are having on various patterns schemes. For example, in the Patterns for eBusiness scheme it is clear that Web services have a major impact on several areas [9], e.g., in the layer referred to as 'Runtime Patterns', Web services are significantly affecting all the technology options; and Web services are the emerging preferred way of supporting the layers referred to as 'Access Integration Patterns' and 'Application Integration Patterns'. We seek to clarify similar impacts of Web services within a Patterns for eLearning scheme. We also anticipate similar observations in areas like Patterns for Learning Management Systems and we note with interest developments like the new IBM/Lotus Learning Management System where the product has its API exposed as Web services.

- **Some scenarios in education involving Web services**

Web services are going to appear in many types of education scenario. Below are brief notes on a few of the scenario types that we have found interesting for various levels of research.

- Hypothetical (near future) scenarios for education providers, e.g., an employer considering a candidate for a job makes use of a 'qualifications authentication service' that is supported by distributed collaborative services from University records management, professional accreditation records management, and personal curriculum vitae management.

- Miscellaneous mainstream examples for education providers. A good description of possibilities can be found in [10, 11, 12]

- Almost all Universities already use a campus portal as an access integration device. Web services are affecting portals in increasingly sophisticated ways, e.g., consider not only that a portal uses Web services as part of its runtime operation but also that Web services are exploitable dynamically for the initial construction and evolving reconstruction of the portal [13]

- Scenarios involving learning objects and learning object repositories. Consider the various approaches to aggregating learning objects e.g., approaches from IMS, or IEEE/LOM, or alternative not specifically educational approaches like MPEG21. In this context we are investigating questions like "to what extent should simple and composite learning objects adopt Web service interfaces?" and "to what extent should a contemporary repository for learning objects be compliant with UDDI?"

- Techniques for modelling educational processes. Acknowledging the impact that Web services are having upon Business Process Modelling we have a project that is exploring whether Web services can have a similar impact on modelling educational processes. The project works with the following enterprise technologies from the IBM Emerging Technologies Toolkit [14] and applies them to an educational context.

- Visual modelling of business processes using a UML profile (a stereotyped extension of the Unified Modelling Language). Within this project we use the same tools and techniques to visually model educational processes.

- Automatic transformation from the visual UML models to XML-based descriptions of the processes. The outputs of this transformation are Web service descriptions that conform to the BPEL4WS specification, i.e., Business Process Execution Language for Web Services [15].

- Execution of the BPEL Web services via the BPWS4J engine - Business Processes for Web Services Java Runtime [16].

This project exemplifies the rationale for our research. The technology being exploited would never have emerged from the world of education. It emerges from the enterprise world and requires experimental adaptation to become exploitable in education contexts.

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Learning object repositories as contract-based Web services

Introduction

To enforce their accessibility and reusability, learning object repositories can be accessed through Web services that provide them with the essential infrastructure for learning objects to be effectively reused. This approach provides learning objects with a number of benefits, as expanded searching capabilities, better management of usage fees, accurate access and usage statistics, etc. But before publishing Web service-based learning object repositories, a common way of specifying what a final user can expect from a given learning object and the conditions under which it can be used is needed. Learning object design by contract [1], a formal notation based on the Learning Object Metadata specification [2], is the more appropriate way to reach this goal.

Software industry increasingly focuses on Web services as an alternative to build distributed open systems on the Internet. But Web service technologies still show a number of shortcomings, some of which have been pointed out in [3]: they are not too adaptable, they are not specifically designed to utilize ontologies and they are not capable of autonomous behavior. In order to deal with these limitations, agent technology is being used to interact with Web services on behalf of a client. We propose to integrate Web services and software agents as a means of helping automated systems to build up new (and more complex) learning materials from the existing learning objects stored in public repositories.

In previous works, design by contract [4] –a technique borrowed from the object-oriented paradigm– has been applied to the description of machine-understandable learning object metadata in the form of learning object contracts [1] [5]. Learning object contracts consist in declaring a set of preconditions (circumstances under which the object can be used) and postconditions (learner expected outcomes) for each learning object. We sketch a Web service-based architecture for distributed learning object repositories that is currently under development. It introduces software agents as a means of searching and validating learning resources described by formal learning object metadata information.

Learning Web services

The specification of a reusable learning object (RLO) can be considered as the required learning outcomes –outputs– that the RLO is responsible for facilitating, when a set of learning conditions –inputs– is given. This can be formalized into what has been called a 'learning object contract' [1] like this:

```
RLO <URI>
   requires
      precondition_1
      precondition_2
      ...
   ensure
      postcondition_1
      ...
```

In our model, contracts are the basis for searching and retrieving learning objects from a repository. We define learning Web services (LWSs) as Internet services that use a SOAP communication interface to expose learning objects that are described by metadata in the form of contracts. The LWS SOAP interface provides the clients with:

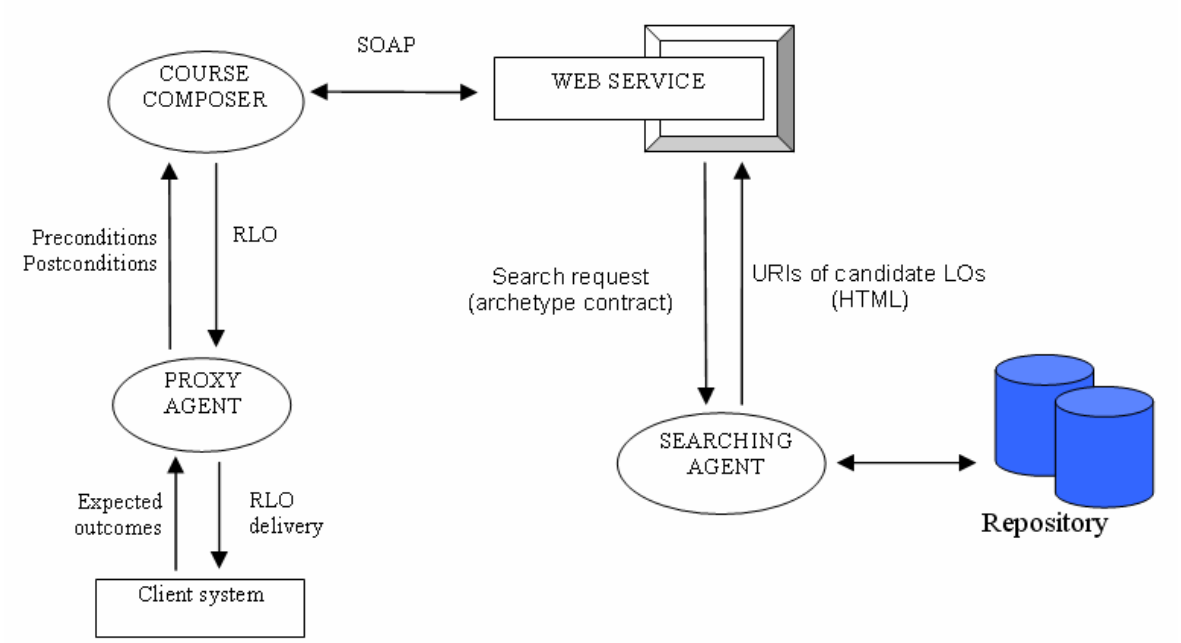
- Discovery of learning objects, based on their contracts.
- Download of learning objects, using learning object packaging technologies [6].
- Learning object metadata retrieval.

When searching, the query operation encodes a learning object search request as a learning object contract archetype that will be in turn compared to the contracts of the RLOs stored in the repository. In this model, not

only RLOs can be retrieved, but also their contracts. Contract retrieval is particularly useful when choosing among RLOs offering similar outcomes, since the assessment criteria is the contract.

The role of agents: an example of interaction

A software agent working on behalf of the end-user application (called proxy agent) interacts with another software agent called "course composer". Composer automatically generates an archetype contract from the expressed needs of the learner (received from the proxy) and will hand it over –in the form of a SOAP message– to expert searching agents located within the repositories and exposed by a Web service. They, in turn, will look up the available learning objects that possibly match the given contract, and will make proposals back to the composer. When examining the list of proposed learning objects, the composer makes a choice after comparing their contracts with the original needs, provided that the differences do not exceed a level of tolerance over which the proposed learning object would be considered not valid.



When sending queries to the composer, the proxy agent uses the standard messaging specification defined by FIPA [7] that enables compliant agents to use Web service models with the benefits of agent technologies.

Conclusions

The described model is transparent for the user. It is also flexible: changing a web client entails just programming a new proxy agent, regardless the rest of the model. And although the simplest proxy agent will just connect the client system with the appropriate composer, proxies are called to play a more relevant role, as for example to dynamically compose the set of post conditions from a user checklist of necessities, or the set of preconditions by analyzing the system on the client side.

We are currently developing a FIPA compliant working prototype of a simple composer agent using the described architecture. Next step will be implementing more intelligent software agents, able to change their goals at runtime, by introducing evaluative programming.

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Using web services to extend an application to meet new requirements

For several projects in the past, we developed an e-learning platform, the ALE (advanced learning environment). This platform consists of a sophisticated authoring tool which can be used to create courses and fill them with template based contents. These courses can then either be exported to static HTML format for viewing them offline or can be used directly with our online course player.

Currently, we are working on a project to provide assistance for planning and conducting field trips for school pupils. The field trips are not limited to one class but can – with the help of the Internet – be undertaken by several parties at once. These parties can even be in different countries. The system we used up to now was a web application completely HTML based. One could open the authoring or the courseplayer in a standard web browser and work with it. This will not be possible for distributed field trips because of the following reasons:

- While a field trip is planned, scheduling of dates and locations may be done outside of the current system, for example in an application written in Visual Basic.

- During the field trip, lots of different devices will be used, including latest generation mobile phones, PDAs and Tablet-PCs. Some of these devices can only display limited HTML or no HTML at all. Most of the devices will run a GUI developed with Macromedia Flash, which is available for almost all hardware platforms we intend to use during the project.

- The HTTP protocol used before in the HTML based solution does not work well when the server has to push data to a client, for example, during a chat or when the client has to be notified of events that happen elsewhere.

Using web services as a standardized way seemed the appropriate way to go since it promised to bring together all the different programming languages and hardware platforms. In the context of the project RAFT we therefore created a web service layer for the ALE platform for several reasons:

- Integration of a variety of user interfaces and interface technologies for team work in heterogeneous distributed learning environments

- Integration of enhanced push technologies and notification services for awareness in distributed synchronous learning

Most web service examples one can find on the net (like a calculator or a money exchange converter) are rather simple in terms of complexity and implementation. Things tend to get more complicated when you want to introduce web services to an existing platform which literally consists of hundreds of classes and thousands of files.

We followed the model-view-controller paradigm in the past and so had database classes, user interfaces and controlling logic already separated. From that point it is easy to see the web services layer as an additional “user interface” and let it make use of the controller classes.

Most of the low-level functionality for providing and consuming web services is done by a Java application server called WebObjects. This application server takes care of all the request handling as well as the wrapping and unwrapping of objects into proper structures. It even allows “session-based” web service operations by giving a client a session ID (a sting consisting of letters and numbers) during the first request. For subsequent requests, the client is recognized by this session ID. The server can store client related information, do client authorization and other things that are standard in today’s web based applications but not yet in web services.

Each web service is described and implemented in a separate Java class file. All the methods marked as “public” in that class are transformed to web service operations when the system is running. WebObjects also creates a WSDL (web service description language) file for the web service based on the Java class on the fly. A WSDL file can be seen as some kind of yellow pages in that it tells a client what operations a web service provides and what input and output parameters the operation can take.

A client written in Java, Flash or VisualBasic can request that WSDL file from the server and lookup operations it might want to call. It then calls the operation, provides input if needed and finally gets some results.

In the event of an error, the server application will generate an exception. The WebObjects application server converts that exception into a so called “fault” and sends it to the client. A fault is defined in the SOAP (simple object access protocol) specification and usually contains an error code along with a text message explaining the error and some additional information. If the client receives such a fault, it should suspend normal processing and show an alert to the user.

While web services allow for easy data exchange, there is still the issue of notifying a client of an event. We decided to take advantage of the various messaging server technologies available. At startup, a client has to subscribe to a messaging server, implementations of this exist for Java, Flash.and VisualBasic. The client can also define a filter to get only notifications for events it is interested in.

Now, when an event occurs, the messaging server sends notifications to all clients. We decided against sending all the data with the notification because of bandwidth restrictions of mobile phone networks. A client has to decide whether it needs that information and pull it from the server via a web service operation.

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Using Web Services to Enhance Efficiency, Maintainability, and Error Handling Across Multiple Instances of Online Collaborative Communities

The Online Teacher Reading Academies (OTRA) and Reading Teachers Talking Together (RT3) represent innovative uses of technology for teacher professional development aimed at K-3 reading teachers in Texas. The OTRAs are hybrid CD-ROMs that focus on content and teacher-to-trainer interactions. RT3, an online community, serves as ongoing support by focusing on the practice of teaching reading through teacher-to-teacher interaction based on OTRA content. Together these products represent a shift away from traditional, face-to-face, teacher professional development.

The first incarnations of both OTRA and RT3 were instances of flat-structured applications that mixed display, logic, and query code and had minimal error checking. This was a very bug-prone environment that proved difficult to maintain. Users would often find themselves frustrated by cryptic error screens and developers who inherited the project had difficulty maintaining and extending the code.

Recognizing the potential of online collaboration and professional development we began a major application redesign that would provide:

1. A skinnable system that could be instantiated and customized for varied audiences;

2. A standards-based web services model that would enable both web and desktop application communication with the system;

3. An overall structure that would permit rapid development and expansion to meet customer needs; and

4. Verbose error handling that would enhance stability and maintainability.

The result of this vision is an efficient, five-tier web application model built using object-oriented code, data encapsulation objects, and a complete web services front-end API (Application Programming Interface). The five layers of the application model include the following:

1. The **Web Services layer** is a SOAP-compliant interface between the client and this web application. Clients can include cross-platform applications with rich graphical user interfaces, or web-based applications with traditional, browser-based interfaces. This inherent flexibility allows us to quickly create customized solutions for clients who represent diverse industries. Because clients only contain remote function calls, the system is highly scalable, and we can focus on the design and usability of the client. The stateless aspect of web services allows us to simultaneously maintain multiple client instances. Client developers can manipulate the XML data from this application into whatever format they see fit.

2. The **Authentication and Authorization layer** is our security and validation layer. This layer solves the problem of maintaining state through web services and also fulfills the very important need for permissions checking and action authorization. A single packet of user-identifying data, similar to a cookie, is passed back and forth between the clients and this application. This packet is evaluated and authorized for each web services call. In future versions, replies to the client will be validated in this layer.

3. The **Business Logic layer** contains all the work-flow rules for this application. This layer contains the main functionality of the system and processes all execution requests. Verbose error handling routines elegantly respond to errors by compiling and returning an XML block to the Web Services layer — and eventually to the client.

4. The **Data Access layer** contains an interface between the Business Logic layer and the database. The separation of business logic and data access encapsulates data extraction from the database and results in a highly maintainable application.

When changes need to be made to the database, changes would only be required in this layer and not the Business Logic layer. On the other hand, if any modifications need to be made in the Business Logic layer, the Data Access layer would not need to be modified.

5. The **Database layer** contains the data for all of the instances that use the application. Our relational databases were designed with a high amount of flexibility in mind. For example, some tables contain an XML field that allows front-end writers to make dynamic changes to forms, posts, and even displays.

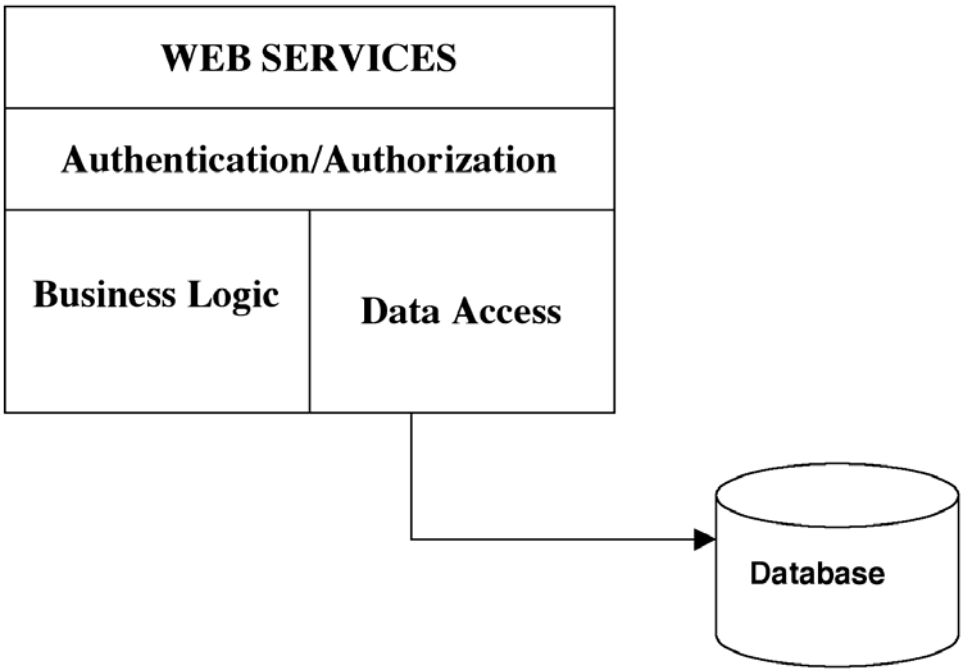

Figure 1: Five-Tier Application Model

The following scenario illustrates an implementation of the Five-Tier Model at work. In this scenario, a user of a client — in this case, the Reading Teachers Talking Together web client interface — has submitted a new topic for discussion in the Reading Teachers' community.

First, the client processes the form data, and creates a SOAP-compliant web services call to our application. This web services call encapsulates the data submitted by the user, as well as the identifying user data packet.

The Web Services layer of our application accepts the request and immediately calls a function on the Authentication and Authorization layer that:

1. Authenticates the user, confirming the user's identification and status, and

2. Authorizes the request to create a new discussion topic through role-based permission checking.

Once authenticated and authorized, the request is passed to the Business Logic layer. The Business Logic layer determines that a new Discussion Topic Object will need to be created and associated with the Reading Teachers' community. This generates two calls to the Data Access layer:

1. Create the new Discussion Topic, and

2. Associate the newly created Discussion Topic Object with the Reading Teachers' community.

When creating the new Discussion Topic Object and making the association, the Data Access layer requests the Database layer to create new data entries.

The Database layer returns its success or failure to the Data Access layer. This result is subsequently passed back to the Business Logic layer, which creates the XML response that will be passed back to the client. The Authentication and Authorization layer (in future versions) validates the result; the Web Services layer creates a SOAP-compliant result and returns this result to the client.

The client application consumes this SOAP-compliant result and displays the success or failure of the new discussion request to the user.

This scenario demonstrates one possible interaction between a client and our application. Web services technology, as part of our five-tier model, provides a standards-based protocol for communicating between clients and our application. Together, the possibilities for rapid and dynamic customization of user interfaces and client application functionality are unlimited.

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ONES – One Stop e-Learning Portal

Abstract

Today finding appropriate e-learning courses, or larger e-learning objects, from different virtual universities is not easy task as they do not provide integrated access. However, providing integrated access is problematic as single e-learning systems are independently created, and hence do not follow or lack standardized metadata or ontology descriptions. In this paper, we present how such problems are solved in the ONES prototype system

1. Introduction

e-Learning sets new requirements for universities: they have to build global learning infrastructures, course material has to be in digital form, course material have to be distributed and learners must have access to various virtual universities.

As single virtual universities are independently created they may provide very heterogeneous functionalities and user interfaces. Ideally, the learner should be able to access all the virtual universities in a similar way, i.e., the heterogeneity of various virtual universities should not burden the learner. How this goal can be achieved is the main topic of the ONES-project. Consequently the main functions of the ONES system are the followings:

- To hide the distribution of e-Learning portals, and
- To hide the semantic heterogeneity (i.e., problems arising from using same words in different meaning and vice versa).

In order to achieve these goals the system will deploy many new technologies such as "one-stop portals", web services, service oriented architecture, ontology editors, and distance measures in searching learning objects.

2. The architecture of the ONES system

There are several alternatives that information sources, e.g., metadata of e-learning systems, can be integrated, so that the data can be accessed as with centralized systems. One approach is to extract metadata from local e-learning systems and store them in a data source, e.g., in an ordinary database. Then the primary idea is the same as with data warehouses [1]. The advantage of this approach is that the system is rather simple to implement (e.g., the QUBER system [2,3] follows this approach). However, its disadvantage is that maintaining a centralized database, which integrates autonomous e-learning systems hardly work in practice. The situation is analogous with multidatabases [1] and federated databases [1], the use of which has shown that local autonomy and tight integration are contradicting goals by their nature.

In order to preserve the autonomy and dynamicality of local systems the ONES-system follows the mediator-based architecture. The four main components of the ONES-system are (see Figure 1):

- Aggregation portal (mediator),
- Wrappers,
- e-Learning portals, and
- Course providers' tools.

The *aggregation portal* supports the learners in searching the courses that match to their specific needs. It differs from traditional database interfaces in a way that in addition to the traditional database queries and keyword based search [4] it supports fuzzy queries. *Fuzzy queries* are similarity based, which means that if the similarity between the courses' profiles and the learner's query exceeds a certain threshold, they are said to match. A problem is that the current database management systems do not support fuzzy queries and therefore the ONES-system has to support them.

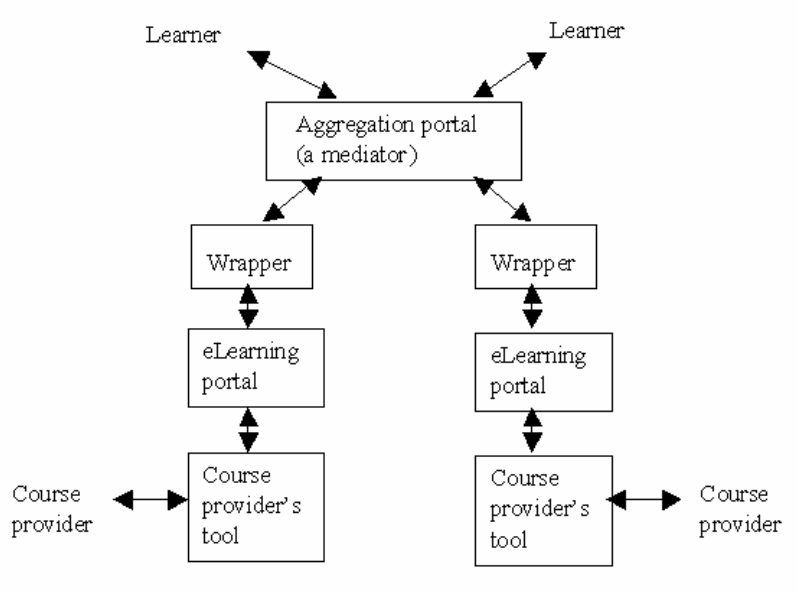

Figure 1. ONES-architecture

From technological point of view the *aggregation portal* is *a mediator* [1]. It supports a virtual view that integrates several learning sources in much the same way as data warehouses do. However, since the mediator does not store any data, the mechanisms of mediators and warehouses are rather different. Since the mediator has no data of its own, it must get the relevant data from its sources and use that data to form the answer to the learner's query. As the data sources (e-Learning portals) are independently created it is obvious that they provide heterogeneous interfaces.

In order to hide the heterogeneity from the mediator there is a *wrapper* [1] between the mediator and each data source. Each wrapper provides equal functionality for the mediator. Ideally, each wrapper provides an interface for requesting the metadata of learning objects, i.e., descriptive information of courses, course packages and programs offered by educational institutions, e.g., universities.

From technological point of view each mediator is a *web service* [5]. Web services are self-describing modular applications that can be published, located and invoked across the Web. Once a service is deployed, other applications (e.g., an aggregation portal) can invoke the deployed service. In general, a web service can be anything from a simple request to complicated business process.

A course provider can enter data about a course through the *course provider's tool.* The main function of this tool is to provide an interface, which facilitates the creation of the metadata attached to learning objects. Basically this tool is analogous to the tools that support the content providers of electronic newspapers [6] in creating metadata items to news articles.

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Free-Open Source Learning Community and Web-Based Technologies

Abstract

This article brings to the fore an online learning community whose activities of open sharing of software knowledge has become an issue for the software engineering community and computer science educators, among others. The Free-Open Source Software Development (F/OSSD) community is discussed by looking at the web services tools, which facilitate interactions, and acquisition and sharing of knowledge between community members. F/OSSD is more than, just, software development, but an interactive online social system of learning- a network of heterogeneous actors of communities and technology.

Introduction

Web services technologies make application-to-application communication in the World Wide Web (a.k.a. *web*) possible. The web is itself a dynamic information-sharing platform built on top of the Internet and uses a variety of *protocols* and *Descriptions* (e.g. *HTTP, SOAP, WSDL, UDDI*) to transmit data from one location to another. These technologies not only made the web very attractive to learning but also have continued to support the emergence and proliferation of communities of diverse interest. One community that has nested and is thriving on such services is the F/OSS community.

F/OSS means having access to the source code, one is free to study, modify, distribute, and improve the code so that the whole community can benefit [3]. The F/OSS community consists of *hackers* who freely contribute and build software by means of the F/OSSD or 'Bazaar" model. The general view is that of an egalitarian network of programmers developing software in a decentralized environment free of hierarchical control structures. Volunteers collaborate and integrate knowledge and expertise to develop robust software systems and programming languages (*Apache, Linux, Tcl/Tk, etc*). F/OSS projects provide a rich field to explore the process of knowledge creation and dissemination. Moreover, they represent decentralized *project-based learning* - an effective way to learn coding techniques by having access to a large *codebase*. F/OSS communities are learning networks, epitomized by the free access to source code and the altruistic sharing of community knowledge.

The F/OSS Learning Community

The F/OSS Learning Community (F/OSSLC) represents a context in which individuals interact with collaborating peers to solve a particular problem and exchange ideas. Collaborative learning and the peer review process emphasizes the importance of shared dialogue. F/OSSLC is composed of developers and users who cooperate to create and sustain a complex learning environment as a by-product of their main activity. Developers work on projects that interest them and by so doing, they acquire knowledge associated with their profession. Efforts of developers and users, who are motivated by a host of intrinsic and extrinsic motives, are coordinated with the help of services available on the Internet. Collaborative software development activities are embodied in *change logs, mailing lists, discussion forums, problem* and *bug reports,* and *project web sites. "*Sourceforge.net" and "freshmeat.net" provide web-based portals for most F/OSS projects. Project initiators are provided public area where they can host their project *web page*, tools to *track* bugs and *patches,* project *support and future requests*, *mailing lists* and *public forums*, project *document management*, and *repository browsing* facilities using the Concurrent Versioning System (CVS). Being the *de facto* F/OSSD coordinating tool, CVS has been criticized because of its inability to facilitate, augment, and support interaction among developers, and is behind equivalent commercial offerings [1] such as *ClearCase, Perforce, web community plus, etc*. Software configuration management tools such as *Bugzilla, BitKeeper,* and *StarTeam* ameliorate the coordination problems posed by the family of version-control systems (RCS, SCCS or CVS). Mailing lists, web sites, and discussion forums provide a simple and effective communication mechanism in F/OSSD by keeping users and developers in touch with each other on issues related to project development, and provide entry point for *legitimate Peripheral Participation*. Paradoxically, software development activities through these collaborative tools do not generate a lot of discussion [2].

Web services available to and for the F/OSSD community enable the storage, retrieval, and distribution of software related artifacts and services. Recent developments in this area are: the Apache *Axis* which is an implementation of SOAP; the *WSIF* which allows access to software independent of its location on the Internet, enabling software developers to freely move applications from one platform to the other, and the *XML_RPC* that

allows programmers to make remote procedure calls, allows collaborative work and interaction among users and developers at an unprecedented scale by utilizing the peer review process.

The authors observe on a constant basis the F/OSSD learning environment (F/OSSDLE). The learning activities of an online collaborative effort of a geographically disperse community of individuals are explored by looking at the interactions between community members, tools used communicate, and interactions between the members of the community and the virtual learning context. The main focus of the study is on the resources and purposeful activities that promote collaborative learning in this context as well as the transfer of learning from the virtual setting to the real-life situation.

Part of our ongoing survey of the F/OSS community's development activities shows that F/OSS projects developed on web environment is on the rise (Fig. 1). We continue to evaluate web service technologies and applications (Table 1) aimed at bolstering the F/OSSD process and increase collaboration and exchange of knowledge between experts and novice programmers.

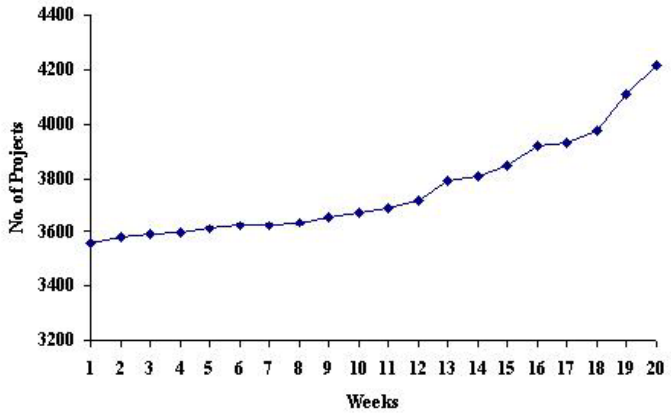

Figure 1. F/OSS Projects Developed on Web Environment.

F/OSS Project Name	Learning Context Function	Location	Author
H2O Rotisserie (*freshmeat.net*)	A system that supports gathering people around ideas- collaboration between projects through the sharing of syllabus elements and joint discussions between projects. It supports **Rotisserie-structured discussions**, which provide an alternative to traditional online discussion boards by structuring the timing and flow of discussions. It can be used for more informal projects cantered around the exploration of a set of ideas, whether the project is a conference, an ongoing public discussion, or a traditional academic course.	http://h2oproject.law.harvard.edu/rotisserie.html	Hal Roberts
Fle3 (*freshmeat.net*)	A Web-based learning environment - a server program for computer-supported collaborative learning (CSCL). The tool allows groups to carry out dialogues and debates. Groups may use knowledge types (**thinking types**) to **scaffold** and structure their dialogues. The Fle3 Jamming tool is a shared space for collaborative construction of multimedia data.	http://fle3.uiah.fi/	Janne Pietarila
MimerDesk (*freshmeat.net*)	A Web-based collaborative learning and group work environment designed for a wide variety of uses such as CSCL and project work.. Its main strengths include a very customisable group system which allows many groups to work simultaneously on a shared database with tools like Projects, Calendar, Tasks, Forums, Links, Chat, Reviews, Instant Messages, and many more.	http://www.mimerdesk.org/	Teemu Arina

CodeBeamer (*freshmeat.net*)	CodeBeamer allows computer science departments and students to work together on software development projects regardless of their locations. Its Web-based portal provides comprehensive **collaborative features** and **code browsing** for software development teams. It is integrated with Eclipse and other SCM systems (CVS, PVCS, SourceSafe, ClearCase, CM/Synergy), and can be integrated with existing tools.	http://freshmeat.net/projects/collaborativesoftwaredevelopmentportal/	Jkoppany
Twiki (*freshmeat.net*)	A flexible and simple Web based collaboration platform suitable for dynamic **intranets** and **knowledge bases**, and for sharing and managing documents and collaborative projects. It resembles a normal Web site, but every page can be changed from a browser. It features automatic link generation, full text search, group authorization, Web forms, reporting, change notification, etc. Plugins can be used to enhance the program and build groupware applications.	http://twiki.org/	Peter Theony
Interact (*Sourgeforge.net*)	A platform for the delivery and support of **e-learning**. It differs from other platforms in that it concentrates on the **social/interactive aspects** of teaching and learning rather than the delivery of content to students.	http://cce-interact.sourceforge.net/	Glen Davies

Table 1. Selected projects using web-based technologies to support collaborative & interactive learning and the F/OSSD process.

Conclusion

Web services that provide the infrastructure for the design, development, and support of the F/OSSDLC are important aspects of the ongoing study. The aim is to have an in-depth understanding of how learning occurs in the F/OSSDLE, how to create a new learning context and how it can become ubiquitous in the future, and support students' participation.

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If Content is King, Context is God! Secondary Usage Metadata & Resources in Supporting Web Services for Learning Communities

This short project report reflects some of the discussions within the Learning to Learn Project and the Special Interest Groups (SIGs) of CETIS (The Centre for Educational Technology Interoperability Standards) in the UK.

The Learning to Learn Project is a 3 year R&D project looking into the practicalities of finding, re-purposing and sharing learning resources in learning object format between study skills tutors in different organizations. The project is part of the Exchange for Learning (X4L) Programme that is tasked with exploring the technical and pedagogical aspects of implementing and using learning object technologies in the UK tertiary education sector. The X4L Programme is funded by the Joint Information Services Committee – the UK body responsible for supporting the use of ICT in this educational sector.

In our early discussions about the services a learning object repository might usefully provide to potential users teachers, cited the need for access to user reviews of learning objects so that they could see what other users thought of the resource and actually did with it. A common, and developing, analogy has been to refer to the review facility in the online bookstore Amazon. In many ways this mimics how many teachers discover, evaluate and share possible teaching resources in real life.

The analogy with Amazon has been developed recently to justify the need to capture various kinds of usage data to enable future retrieval and analysis by different services that might not even exist yet.

One participant in our project, looking into the future, said "Wouldn't it be great if a learner on a course had a choice of resources they could use for their independent study and could search a repository to select their study materials using a number of different criteria? On further discussion we outlined the kind of information services that such a system might provide about a resource:

- Type and level of course it is intended for
- Type and number of courses where the resource is used
- Subject content
- Student reviews and ratings
- Teacher reviews and ratings
- Number of students who have downloaded / used the resource
- Students / Teachers who used this resource also used these resources…
- Recommendations by the system based on user profile and tracking data etc

Of course this kind of scenario implies that the learning environment works closely with the repository and administration systems etc. to record and collate data to make it available for analysis to provide this information – which of course is one of the fundamental benefits of interoperability.

By developing these kinds of services and the infrastructure to support them we also make possible the development of new services that might not currently exist. One intriguing possibility is the ability to use this infrastructure to support research into learning and teaching in different domains. There are some clear parallels to the field of bibliometrics where bibliographic citations are analyzed to uncover important relationships that may provide the basis of new discoveries. The work of Swanson is often quoted in this regard; his analyses of bibliographic data from distinct areas of specialization enabled him to propose hypotheses that were later validated by bio-scientists. Such hypotheses were the link between migraine and magnesium deficiency (Swanson, 1988).

On this foundation we may be able to 'mine' data about resource usage to support hypotheses about learning in different domains. The types of data that we could mine for analysis could be empirical (usage data etc.) and qualitative (user reviews etc). In this scenario this secondary usage metadata could be more valuable than the resources they are connected to for the organizations that are creating and using learning objects.

The need to capture qualitative data about the actual use of a learning object and the potential value of this is beginning to be acknowledged (Robyn & Dalziel, 2003). Access to this kind of qualitative data is going to be essential in both creating and sustaining learning communities. If the online 'environment' is right people will supply time and expertise to the online community because of the perceived and real benefits of being part of the community. Constant et al (1996) have shown how these kinds of loose ties can be of real practical benefit to the participants – a kind of old fashioned mutuality in cyberspace.

To start with it may be best to have a 'star' rating system for resource evaluation which could be applied according to a number of criteria. This has the benefit of being quick and machine-readable. But we need to be able to describe and share the contextual information about the use of these resources to sustain a learning community that uses them, getting the right mix between automated systems and human agents is going to be crucial. In our project discussions we keep coming back to the traditional role of the librarian in providing management and quality control functions for learning object repositories - to which we can add the role of facilitator.

A note on terminology: The term secondary metadata is currently being used to describe a very wide range of types of information. This is rather misleading and lead to much ambiguity. These types of data are really resources in their own right – it would be more accurate to describe them as 'secondary resources' i.e. resources that are linked to a primary resource by some kind of relationship. I am indebted to Aida Slavic of the CETIS Metadata SIG for making this distinction.

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Constructing Context-Based E-Learning to Support Telehomecare Communities of Practice

Telehomecare (THC) is the provision of remote patient visits using advanced technology. Research findings indicate that health care efficiencies and improvements in the quality of care may result from telehomecare delivery.[1] The East York project team and partners have been working intensively for the past 24 months to plan, develop and implement an integrated telehomecare project in Ontario.[2] Technological innovation has required partners to re-examine traditional ways of providing patient care.

Telehomecare is a relatively recent innovation in Canada. At the time of project start-up there was no formal THC training program for health care providers in Canada. Compounding this absence is an increasing skills gap: there is an increased demand for telehomecare, and few health providers are trained to work in this environment. With a need for a pan-Canadian approach to training to help combat the "Silo-ization of health care," a team-based e-learning approach to THC was formulated.

We used a participatory design (PD) methodology to encourage wide participation and input into the design process of the THC program in order to encourage increased use and efficacy of the program.[3] This entailed an iterative e-learning design[4] and a tricyclical data collection that was carried out prior to program development, during THC implementation, and upon course completion/review.

The overlapping of healthcare roles presented an instructional design challenge that we are meeting with a Role-Based Instructional Design (RBID) model, enabled by an XML metadata system. The RBID works in conjunction with models of problem-based learning and the development of learning organizations. Collaborative and constructivist learning models, coupled with our iterative program development, are well suited to fostering learning as an additive process of continual engagement.[5] We are seeking to foster the development of clinical communities of practice within a "learning ecology"[6] approach to organizational learning and capacity building.

The RBID works within this organic context by surrounding each health care role with the information specific to that role for learning about THC technology, working in THC teams, and ensuring effective patient outcomes. Surrounding the role-specific information are links to the other roles' learning paths, cross-referenced with metadata to particular aspects of conducting THC. Surrounding these is ancillary information that links the learner to the wider context of Telehealth and Telehomecare. (See Figure 1)

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[11] See, for example, the following: Black et al. 2001, Bondmass et.al. 2000, Britton et al. 2000, Dale et al. 2003, Maiolo et al., 2003, Port et al., 2003, Scott 2003.

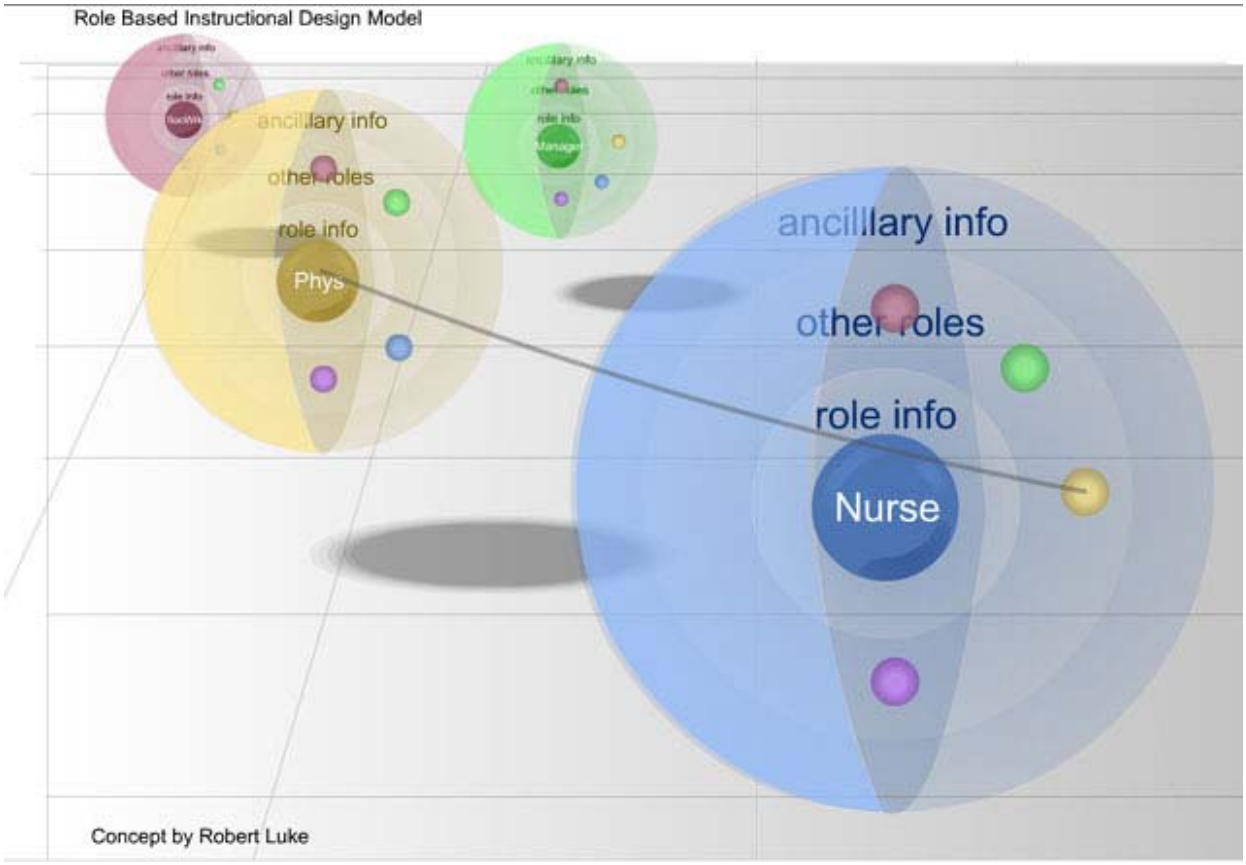
[2] The East York Telehomecare Project e-learning development is called "Distributed Team-Based Learning in Telehealth and Telehomecare," and has been funded by CANARIE, Inc. (http://www.canarie.ca/), and the Office of Learning Technologies of Human Resources Development Canada (http://olt-bta.hrdc-drhc.gc.ca/). Please see http://www.telehomecare.ca for more information.

[3] (Clement & Van den Besselaar, 1993; O'Day, Bobrow & Shirley, 1998; Beamish, 1995; Stolterman, 2001; Gómez & Hunt, 1999; Gómez, Hunt & Lamoureaux, 1999; Whyte, 1999; Scharffenberger, 1999; Trigg, 2000)

[4] (Luke, 2003a)

[5] (Lave & Wenger, 1991, p. 50; Luke, 2003b)

[6] (Looi, 2001)



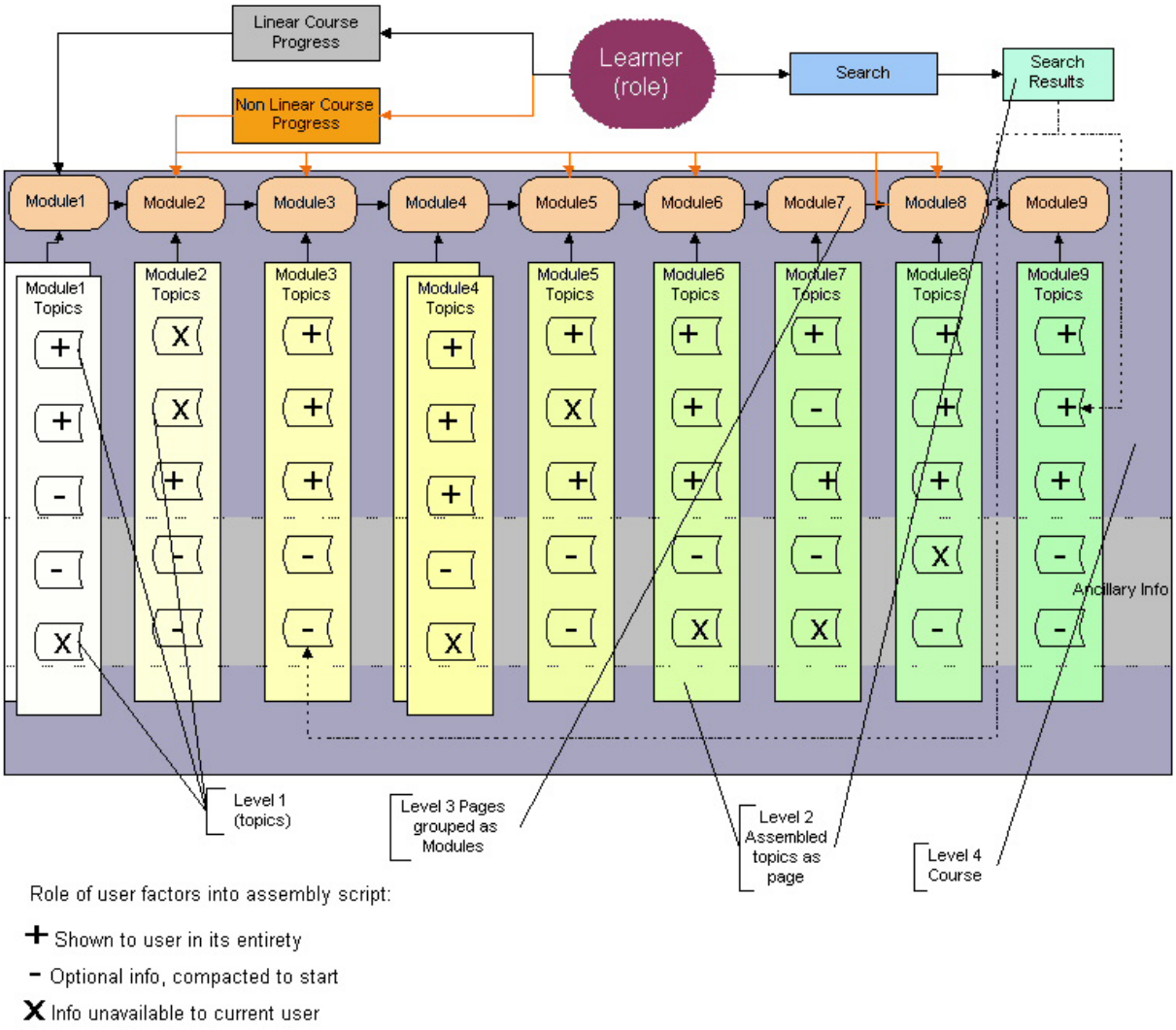
To date we have constructed only the learning paths for the THC nurses, and are currently engaging in further content development for the additional roles. While there is a large body of content available,[7] we focus on the sequencing of the learning activities. Learners will build cognitive paths through the learning materials that will be tracked within metadata profiles, thereby rendering explicit the creation of communities of practice within the team-based learning. These learning paths will be available for others to follow as a kind of preferred path based on previous experience, though there is a danger that "learning ruts" will become entrenched.

We are using the CanCore implementation of the IEEE LOM[8] to archive our learning objects, and are extending aspects of the LOM to account for our sequencing needs. A workgroup consisting of researchers, nurses, instructional designers, programmers, content area experts, metadata application experts[9] and cataloging experts is developing a metadata Content Organization Model (COM) for the RBID. Learners will see essential information to their role presented in full. Information that is essential to other roles, but is still of interest, is presented as inline expanding links. Ancillary information is linked to relevant areas of the course. Information that should not be seen by the current role is not displayed at all. (See Figure 2)

[7] Learning material includes including text readings, videos, interactive clinical simulations, and self-assessment quizzes within learning activities that encourage critical reflection and communication among and across health care constituents.

[8] See http://www.cancore.ca.

[9] Recombo Inc. See http://www.recombo.com.



Our COM will help us to ensure that our RBID requirements do not interfere with our archiving needs. The *General.Structure* and *General.Aggregation* as well as the *Relation.Kind* and *Relation.Resource* tags within CanCore can handle a large portion of our content organization. However, this will only assist in the dynamic assembly of our learning objects, with no regard to specific roles. Our current work is extending the metadata and the content sequencing and assembly model so that we will be able to use any standards or specifications compliant Learning Management System to deliver our content aggregation to learners on demand.

To encourage clinical skills transference and the development of communities of practice, we employ an extensible online learning model that assists learners in translating the skills learned online into the material practices of everyday life.[10] This is accomplished by adding a requirement that a change in practice must be demonstrated over the duration of the online course.[11] The online learning is scaffolded by real-time use of technology, and will result in competency training as the culminating learning event in the course, thereby preparing practitioners to conduct THC visits. Online communication mechanisms will be used as a staple for generating community and knowledge building, with the results archived and indexed within metadata profiles for future reference.

When our e-learning system is complete, learners will share change experiences with one another, and compare the differences in their own implementations, thereby building a greater, collective body of knowledge about the core content area, and about its emergence into "real life" practice. We anticipate that providers will report that

[10] (Luke, 2003a)

[11] (Atack, 2003)

the e-learning program prepared them to deliver THC in a safe, quality manner.[12] Equally important, we anticipate the program will promote interdisciplinary communication and knowledge building and provide support for team-based care as practitioners take their first steps towards THC delivery. The technical infrastructure of the RBID will enable us to develop and cross-reference further roles, and track learner patterns within context-based educational ecologies in support of the provision of THC and patient disease management.

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[12] The course is currently in its third redevelopment cycle, and has yet to be launched in its entirety. When it is, we will use the Online Learner Support Instrument developed by Atack (2003) to conduct program effectiveness evaluation. This will feed into the next development cycle.

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Evolving a Community for Evolving Learners

Abstract

Columbia's Technology Integration Partnership (TIP) [TIP] is upgrading its web-based software infrastructure called CEL to support interactive, real-time collaborative educational activities for a community of human learners and intelligent software agents. We have done initial deployment and testing of the software in New York City public schools. Current and future work focuses on further testing and integration of these activities into existing TIP classroom activities; enhancing and adapting the software infrastructure for use by students, educators and developers outside the TIP project; and gathering data and incorporating additional pedagogical methods to better enable, measure and support human and agent learning over time.

Introduction

We have been interested in creating a virtual community of learners, in which participants engage in interactive, real-time multi-user activities in educational skill-oriented domains. Our goals are, first, to use the Internet to create a long-lived community where learners in disparate locations can come together in real-time in a safe and secure environment to form learning partnerships based on skill level.

Second, to use the data gathered from monitoring student performance in specific learning domains to build models to study and improve the learning process, both directly for student participants by suggesting appropriate learner pairings and presenting individualized problems for each student; and indirectly by building intelligent agents that can serve as smart playmates, to overcome the potential real-time unavailability of human learning partners.

Third, in an educational climate increasingly focused on automated skills-oriented testing, to suggest that our more longitudinal development of real-time interactive play/learning activities will present an alternative view of the use of software in the evaluation process. A system that has the ability to provide comprehensive reporting to teachers on their students' activities and performance while engaged in the system offers another metric for measuring student achievement beyond standardized testing. We speculate that this may be a more realistic and attenuated metric, especially as it can be measured over time, in a non-stressful, everyday classroom environment.

The CEL System

Our current work updates an earlier implementation of the framework called CEL (Community of Evolving Learners) [Sklar, 2000]. CEL is an Internet-based system where students engage in two-player educational games. These games are straightforward (i.e., there is no glitz) and provide practice at basic skills (e.g., spelling, typing, math, geography). Players come to the CEL website, select a unique anonymizing graphical ID (called an "IDsign"), and enter the "playground" associated with each game. Once in a playground, a player can invite or be invited by another player to play a particular game. Once invited, a player can accept or refuse an invitation to play. When one player invites and another player accepts, both players are taken to the "game", usually implemented as an interactive applet.

The applets provide controls for each player to make moves in the game, and feedback so that they can see the results both of their moves, and of the other player's moves, in real time. Some of the games are competitive, where a player tries to do better than another at particular skill-oriented tasks. Other games are cooperative, in which players try to improve on each others' moves to achieve a better "team" score. When a game is finished, the moves and the performance of both players are stored and compared to their past performances at the same game as well as performances of other players. As described above, this performance data may be used to train software agents as playmates residing in the system.

In this updated implementation, the server software that implements anonymous play, coordinates invitations between players, and tracks game history and player performance is an update to the original work. The original work was done in C as CGIs, which used text files for storage. The new software is written in PHP [PHP], using a Mysql [MYSQL] database for data storage. We expect the new system to be more scalable and adaptable as we continue testing and deployment in more schools.

Initial Results

We have performed initial tests of the system with an ethnically diverse class of 23 fifth graders from a middle school in a lower-middle class neighborhood in New York City. (Figure 1)

Figure1. Students from the participating fifth grade class

In our tests, each student played three different matches with one another of each of two different typing games- a competitive game called "KeyIt" (Figure 2), and a cooperative game called "Monkey" (Figure 3).

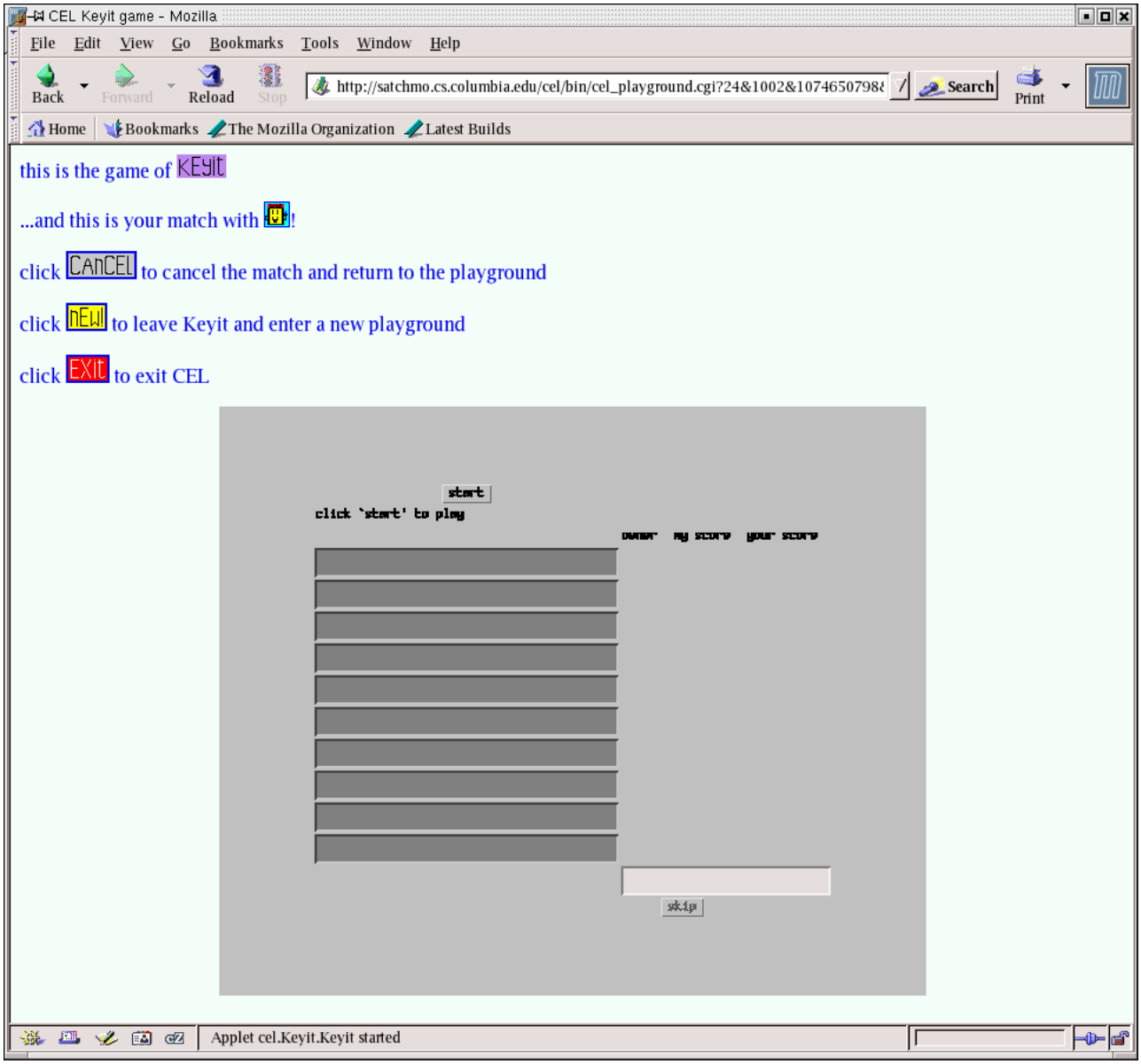

Figure 2. KeyIt is an interactive, competitive, two-player typing game

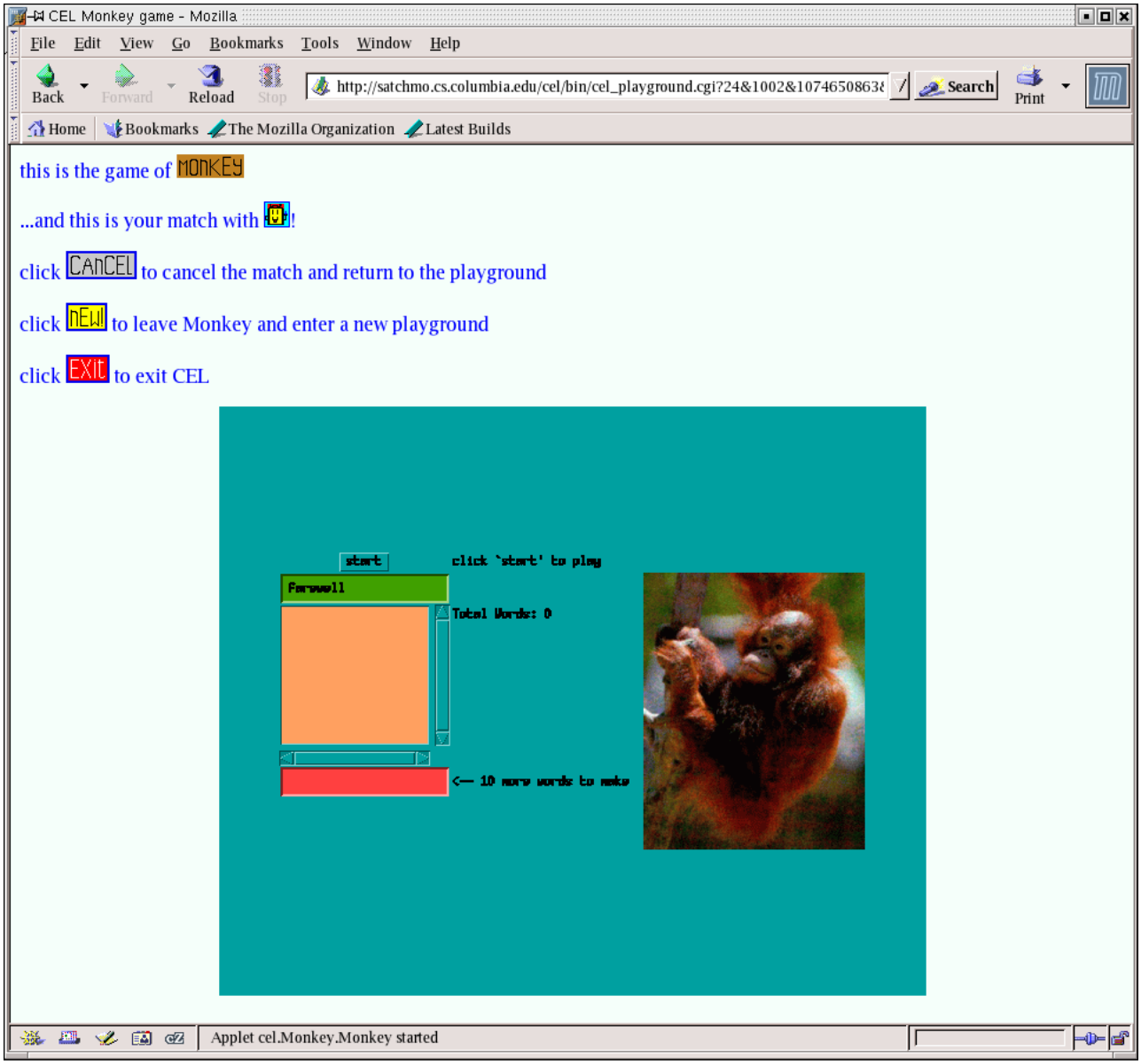

Figure 3. Monkey is an interactive, cooperative, two-player typing game

The test was extremely successful in providing feedback about the critical aspects of the system- the anonymized login process (Figure 4); the mechanics of player invitation and playmate selection; the competitive and cooperative aspects of game play; and the reporting and data collection capabilities. Improvements are being made in all areas, and we expect to run further tests with new groups of students in Spring 2004.

Figure 4. An anonymized login process using graphical "IDsigns"

Future Work

In addition to continuing the testing and deployment process, our longer term goals are to more closely integrate the CEL system into the existing TIP program; to enhance and package the software for use by interested parties outside the TIP research group, and to use accumulated data to refine learning and teaching models and improve and refine our activities.

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Learning Teams in Online Courses

1. Introduction

It is a given that online courses usually include either synchronous or asynchronous requirements for student participation. In the popular Blackboard system for hosting courses, for example, there is a special section called, Discussion Board, that allows instructors or students to post threaded messages to which other students reply. This type of discussion, while allow individual students to ask questions of one another, does not develop a sense of community, nor foster pragmatics abilities associated with group dynamics that are required in professional life. This paper will advance a praxis of online courses that uses virtual learning teams to build synergistic team efforts among students in online courses.

2. Why Online Learning Teams

The justification for learning team/communities in online courses is originally to compensate for the fact that students will not meet each other in a face-to-face encounter (Abbas, 2003). In the post-TQM world of corporate and professional endeavors, groups and teams have become the rule because of the synergistic effects of combing the efforts of individuals into small groups (Scarnati, 2001). Another important reason for team-based work is that technology-enhanced work and learning environments have become more complex, to the point that individuals simply can't work in isolation (Kaplan & Welker, 2001). Learning teams serve as a nexus between the work education, between theory and practice, and between individuals and respective groups (Gibbons, 1999). A recent study compared traditional classroom efforts on group assignments were compared with similar assignments in classes that were computer-mediated at a distance (Scifres, Gundersen, & Behara, 1998). The results of this comparison indicated that while teams working through the medium of computers only were less satisfied with their projects, but they evidence a higher rate of learning than their traditional counterparts. Another study conducted by Lantz (2001) reported that professionals working in computer-mediated teams were more task oriented than traditional teams, in support of the earlier study.

3. Learning Teams for Al l Online Courses

The University of Phoenix (UOP) offers undergraduate and graduate courses to 72,000 students in courses with a small class size of eight to fourteen adult students. Learning teams are an essential part of all UOP Online courses. Each of these courses is subdivided into learning teams of 3-5 students, who collaborate together to complete assignments that are especially beneficial to working adult learners (Learning team handbook, 2003). As described in the Learning Team Handbook, "Learning teams are small, intact groups of students formed at the beginning of each course from the larger cohort. Teams meet…to complete group assignments and projects" (p. 2).

A typical Learning Team assignment is like the following one which has been taken from the graduate course, E-Learning in the Global Environment. Each learning team is instructed to work collaboratively for all six weeks of the course to develop a "best practices" manual for conducting e-learning. This manual must address the topics of content, technology, assessment, communication, instructional design and delivery, as well as components of class interaction, including diversity, globalization, culture, courtesy, research integrity, flexibility, and rigor. The Team completes one chapter of the Manual each week, and during the last week of the course, submits the compilation of chapters and a PowerPoint presentation of its contents.

4. Managing Online Learning Teams

The size of teams is an important element of the success of these online learning groups. Research with Learning teams indicates that they work optimally with four or five members (Learning team handbook, 2003). A student conducted about optimal team size in undergraduate marketing courses returned findings that learning teams work best when team size is equal with the course (Cosse, Ashworth, & Weisenberger, 1999).

In addition to the issue of team size, it must be stated that online Learning Teams will not succeed automatically. Students need orientation to the successful conduct of team activities. An essential concept that is offered at UOP Online for successful Learning Teams is "followership" (Lundin & Lancaster, 1990). Students are introduced to this term in courses at the beginning of their online programs, so that they become

capable in learning situations where they are not working autonomously and often are cast in subordinate roles to others in their groups. The key terms stressed for team members are integrity, ownership and versatility.

In closing, one other factor needs to be added to the list of necessary characteristics of students in Online Learning Teams: accountability. Team members should be provided the opportunity to rate the contributions of their team colleagues. Instructors are advised to create weekly rating forms that add accountability to individual team members' efforts. This gesture is necessary for two reasons: each individual must know that her/his efforts on the Team are being monitored, and the team membership in general must know that fairness is being applied in the evaluation of team efforts.

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Multiplayer Games and Learning Communities

Can Multi-user Games constitute tools for the development of learning communities? Although a large body of research, over the past three decades, has been dedicated to the potential of digital games as learning environments, there is little evidence on whether a learning community can be developed through multi-player gaming. With the implementation of high technologies, digital games have evolved from simple arcade-like games, to environments integrating Artificial Intelligence and Virtual Reality. One of the latest trends in gaming is the integration of on-line - multiplayer feature, where the player competes or collaborates with other real users over networks. Communities of gamers are increasing continuously. What would the learning implications of a Multi-user game be if the purpose of the game were the attainment of a learning objective?

Members of virtual Learning Communities form relationships in order to pursue a shared goal. The social interactions developed through these relationships sustain the community and thus sustain learning (Nichani, 2000). Through these interactions the members of the community exchange perspectives on a specific topic. Multiple viewpoints are presented in order to attain a goal. Diverse knowledge and skills are synthesized towards the solution of a problem and problems are solved in a variety of ways. Arguments and constructive debates are fostered promoting a deeper understanding of the topic (Collins & Bielaczyc, 1994). Through the learning communities members have not only to share their individual efforts but also to learn how to co-operate and resolve conflicts. “A culture of learning” is fostered in learning communities, as the individuals “learn how to learn” (Collins & Bielaczyc, 1994).

Tools such as newsgroups, discussion fora, chat and messaging via the web are commonly used for the development of on line communities but they do not necessarily consequent to learning. When such tools are present in conventional on-line learning environments students are mainly motivated to use them by extrinsic factors such as submitting an task or ask a question to instructors or peers, and therefore these tools are not sufficiently used (Nichani, 2000).

Intrinsic motives for on-line interactions can promote active participation of the users in such communities. In a Multiplayer game, participation in the virtual communities is linked to the successful completion of the goal. Players compete with each other or cooperate, exchange tips and perceptions on the game, and even develop new strategies for playing, in order to ameliorate their performance and complete the game successfully. On the other hand, the compelling content of games attracts and motivates the users. Players enjoy the game “per se” regardless of the end result.

Beyond the entertainment aspect, there is evidence in the literature that digital games have the potential to constitute effective learning environments: a topic can be presented spherically, they promote active participation and initiative from the part of the users (Tansey and Derick, 1969), they can support autonomous and complete tasks, and can adjust to the needs and preferences of the users. Inherent features of games, such as the specific and clear aim, the challenge, the competition, the imagination and the curiosity they evoke facilitate the attainment of learning objectives. It seems that games can facilitate the acquisition of motor (Greenfield, 1984), verbal (Ellington et al., 1982), intellectual and cognitive skills (Loftus and Loftus, 1983); they can affect attitudes and encourage the building of cognitive strategies. They engage, thus, the user both intellectually and emotionally (Romizsowski, 1974).

There is still little evidence on whether multi-player gaming can support learning. Research in the area of Computer Supported Collaborative Learning or Work could, though, be applied to the area of on-line multi-user gaming for educational objectives (McGrenere, 1996). Students can reach better learning and interpersonal results through collaborative learning rather than through individualistic learning environments (McGrenere, 1996). Collaborative learning reinforces intrinsic motivation of the students for the attainment of the goal, rather than extrinsic motivation (Hymel et al, 1993). Cognitive strategies such as the presentation of arguments in order to solve a disagreement are supported (Nastasi and Clements, 1993).

It has to be highlighted, though, that digital games alone cannot be used for education. Games can foster misconceptions Kolson, 1996) and thus coordination by an instructor and face to face meetings are essential not only for safeguarding the quality of learning but also to promote engagement of the students/games (Feenberg, 1989, in Nichani, 2000).

The combination of the positive effects of collaborative or cooperative learning through computer supported environments and of the interactions and relationships emerging through on-line communities, supported by a compelling context and content such as a digital game, provide an area of research and, with the implementation of an appropriate educational methodology and design can constitute powerful tools for education and learning.

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Symbolic Interactions in a Virtual Learning Community: Understanding the Creation of Shared Meanings in a Mediated Environment

Although changes have taken place, today's classrooms are still too closed and homogenous to provide students with a global perspective. Distance learning technologies afford one way in which educators can offer students the opportunity to engage in multiregional, multinational, and multicultural collaboration on a global scale. This potential addresses Robert Selman's contention that educators need to devise ways for students to progress beyond their egocentric views of the world (as cited in Sugar and Bonk, 1995). Reil adds that electronic communities will provide students with a more global education and enable them to view complex issues with a more global perspective (as cited in Sugar and Bonk, 1995). The advantage of distance learning technologies, whether they be interactive television (ITV) or computer mediated communication (CMC), is that they enable students to create shared meanings around roles, ideas, objects, and perspectives.

Both ITV and CMC are becoming more common in educational settings, not only in colleges and universities, but in K-12 settings as well. Many institutions are realizing that distance learning technologies can allow students to connect to people, places, and events outside the four walls of a classroom, without the need to physically leave the classroom. ITV's power is that it allows students to make these connections live, face-to-face, and interactive. CMC technology enables students to learn and collaborate *anytime, anywhere*. These new opportunities for collaboration and student interactions engage students in a process of shared meanings, a necessary component of community and culture building. Teachers can now take advantage of these new technologies, and the worlds they open up to students, to change the way they teach and learn in today's classrooms.

Just as there are many challenges in a conventional learning environment, instruction that is mediated by technology faces many challenges that can impede the effectiveness of the learning intended during these mediated interactions. The barriers of distance and of the technology used to bridge that distance are often difficult to overcome. Kochery (1997) found that students learning over a distance often feel alone and separated from not only the teacher, but also from the socialization with other students. Interaction is a key ingredient to the social construction of meaning and information. Students must feel comfortable and willing to work with others to build on what they already know in order to create a new understanding of the world around them. Kochery (1997) went on to say that an important part of learning involves actively working and interacting with other students to construct knowledge. Without these interactions, student isolation can be a significant barrier to students' understanding of concepts and content and skill acquisition.

Studies have examined interaction and collaboration in conventional classroom environments. However, few studies or theories have addressed instruction mediated by ITV or CMC technologies to support student collaboration. This issue of collaboration in a technology-mediated environment is one worth investigation and analysis. Subsequently, there is much more that could be done to better our understanding of the mediated construction of communities, societies, or social worlds. Altheide (1994) pointed out that little attention has been given to how individuals communicate and engage in social activity in an electronically mediated environment and how this technology influences this interactivity. Work by Tinzman, Jones, Fennimore, Bakker, Fine, and Pierce (1990) suggests that collaborative groups of students learn better and solve problems better than students working individually and that communication and collaboration between students is essential for learning. However, these studies do not involve the use of electronic mediating technologies. Other than the work done by McLuhan and Fiore (1996), there are few researchers or theorists that have addressed mediation and developed theories pertaining to the interplay between the elements of mediation. We know that media has a profound impact on how the content is understood, and in a broader sense, how we all make sense of our own lives. Therefore, it is important that new questions be asked about this phenomenon in the context of electronically mediated environments and that research be conducted based on these new questions to better understand the phenomenon in question. There is a need to make sense of the student interactions that take place in mediated collaborative environments (Sugar and Bonk, 1995).

There are many questions that must be asked regarding student collaboration and electronic mediating technologies that have yet to be answered. According to Maines and Couch (1988), these new technologies are changing our sociological systems. McLuhan and Fiore (1996) continue to argue that the medium is the "massage." It is important for us to understand how and why this is happening and what the impact will be on us later in our students' lives. There is much to be learned about this new educational environment and the impact

that technology might have on the mediation of communication and collaboration between students and teachers in today's classrooms.

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Developing an On-Line Learning Community: Four Essential Guidelines

Cyber education is upon us. As educators, we are presented with many exciting challenges to teach skills that were historically taught face-to-face in a classroom. Today's children and youth were raised with computer technology, and this technology has been embedded in their culture and daily lives. Yesterday's classrooms were filled with black boards, chalk, and perfectly aligned desks. Today's modern classrooms have workstations, computer terminals, wireless computer networks, color monitors, electronic dictionaries, Internet search engines, and SMART Boards**.** In addition, students communicate using the fastest digital cellular phones available and have 24-hour access to text-messages, e-mail, Web Cams, Web Photos, and Internet Web sites around the globe. Schools, colleges, and universities are rapidly growing and changing to meet the technological transition to this computer growth. Professional educators are rapidly learning how to teach on-line as proficiently and professionally as they can. The challenges are varied, and each new day brings about another faster and smarter software.

Cultivating professional educators that understand how to teach on-line is not a clear or simple task and often requires more energy and preparation time than a standard face-to-face class. Creating a learning experience on-line involves social relations. Social relations provide a framework for growth. The computer is a mediating tool that allows for instant communication in a synchronous or asynchronous mode, however, much of it is still being studied or developed and it is for this reason that the interactions and interfaces between the human being and the computer is a rapidly growing field. On-line education is at the forefront of existence. Universities, colleges, and schools around the globe are increasing their efforts to harness this technology. As a doctoral student studying Educational Technology at Pepperdine Universities Graduate School of Education and Psychology in Los Angeles, California, I have spent the last few years studying and learning how on-line learning communities can best be developed and maintained. During this time, I have been exposed to numerous on-line learning programs throughout the nation and globe and have observed common and universal factors that are basic *items* of on-line learning communities. I admit there is no magic formula or correct method of teaching on-line. However, these four basic factors may provide an essential foundation toward cultivating a healthy on-line learning community.

For anyone starting or thinking of starting an on-line course or curriculum, creating and maintaining an on-line learning community should involve basic levels of interactions for learning, growth, and cognitive development to occur. The following are a few suggestions that have worked based on my academic experiences at Pepperdine University. These four guidelines have been interwoven with our face-to-face time and residency experiences and appear to be essential ingredients to our program's overall success. These four factors are ever present and may be helpful to someone who is trying to start an on-line learning program or community.

1) *Have an initial face-to-face meeting before starting on-line.* Most on-learning communities are encouraged to meet for initial and regular face-to-face time. This allows people to meet and develop meaningful, formal, or informal relationships. If all parties in the learning community meet prior to going on-line, most future interactions may be less awkward or mysterious. It fosters a much more personal and meaningful learning interaction.

2) *Have a basic-to-advanced understanding and working proficiency of the computer and software.* Proficient use of the technology is paramount to the success of the on-line learning community. All parties (teachers included) are required to have a basic understanding of any software or computers. Sending and receiving all types of e-mail is paramount to success. Web-site research, instant messaging, news groups, and common or virtual workspaces must be available for students and instructors.

3) *Be professional, tactful, and respectful on-line*. Respect and politically correct language is a must when working on-line. E-mail can be an extremely emotionally charged means of communication. Sarcasm or joking on-line is best done with emoticons or specifically mentioning to the receiving party that you are joking or making light of a situation or interaction. Most people know that smiling or frowning cannot be seen on-line and it is for this reason that emoticons should be used and tactfulness maintained. When working on-line all parties are encouraged to be as professional and ethical as possible.

4) *Be supportive to your on-line students*. Learning on-line can be an extremely interactive and fast-paced experience. Communication is paramount to success. Supporting students is important in all instances. This norm is equally important when teaching or cultivating an on-line learning community.

Closing Summary

Creating and maintaining an on-line learning community requires a social closeness, common ideals, beliefs, and professional nurturing. Social learning on-line is how people learn. Cultivating relationships is the key to success. Computer technology allows us to communicate and exchange ideas in short time. People who use on-line learning communities share ideas, philosophies, and grow using computer technology.

Ones' physical location and time zone are not an issue with on-line learning communities. Collaboration is possible with proper planning and coordination. Leaderships and social relations become factors of involvement and development. Over the next couple of years, I plan to further explore and examine how these factors can be better improved and developed.

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Regular Article: DVD – A new component in educational technology

1. Introduction

In the following paper we will discuss and report on the production and use of DVD-technology in distance education. The applications and developments refer to development at FernUniversität Hagen, however the technical and didactic considerations are widely independent of the institutional environment.

After discussing some general characteristics of DVDs we will report more in detail on a concrete production in the area of business administration.

2. DVD-in the market

Currently DVD players and DVDs themselves are sweeping the consumer market and prices are coming down continuously. However up to now the DVD seems to have not yet gained the same importance in educational applications at least not at tertiary level. DVDs with complex educational content are still a rare bird.

Nevertheless in the commercial market for audiovisuals the DVD = „Digital Versatile Disc“ seems to outperform the traditional video cassette. The new optical data carrier offers greater storage capacity that can be used for better image quality and is actually sold with every new PC as a combined CD ROM/DVD drive. The price of separate DVD players came down to less than 50 Euros. Therefore the Centre for Distance Study Development at FernUniversität Hagen actually explores intensively the potential of DVD with respect to didactic concepts, design and technical production. The first model productions have been launched in 2003 covering different academic areas such as education, sociology and business administration.

3. Characteristics of DVD

There are different types of DVDs. For our clientele the most relevant type is the DVD-video that can be played by DVD player or PC.

However if content of CD-ROM character is added it can be played on PC only. DVDs are composed of two halves. According to the number of writable sides and layers the storage capacity of a DVD varies, e.g. DVD-5 (4,7GB), 1 Side / 1 layer.

There are different formats for writable DVDs

DVD-R (Authoring), 4,7GB, 635 mm,
Digital video (MPEG-2)
Digital audio (PCM, AC3, DTS, MPEG-1)

The maximum playtime can exceed 1 hours, widescreen and surround-sound can be provided. Attention should be paid to regional code settings.

For learning some important characteristics are the following:

seamless switching between streams

- up to 9 videostreams („multi camera angle“)
- 8 audiostream for every videostream (different languages, different audio formats)
- up to 32 Subtitles (languages, Bitmaps)

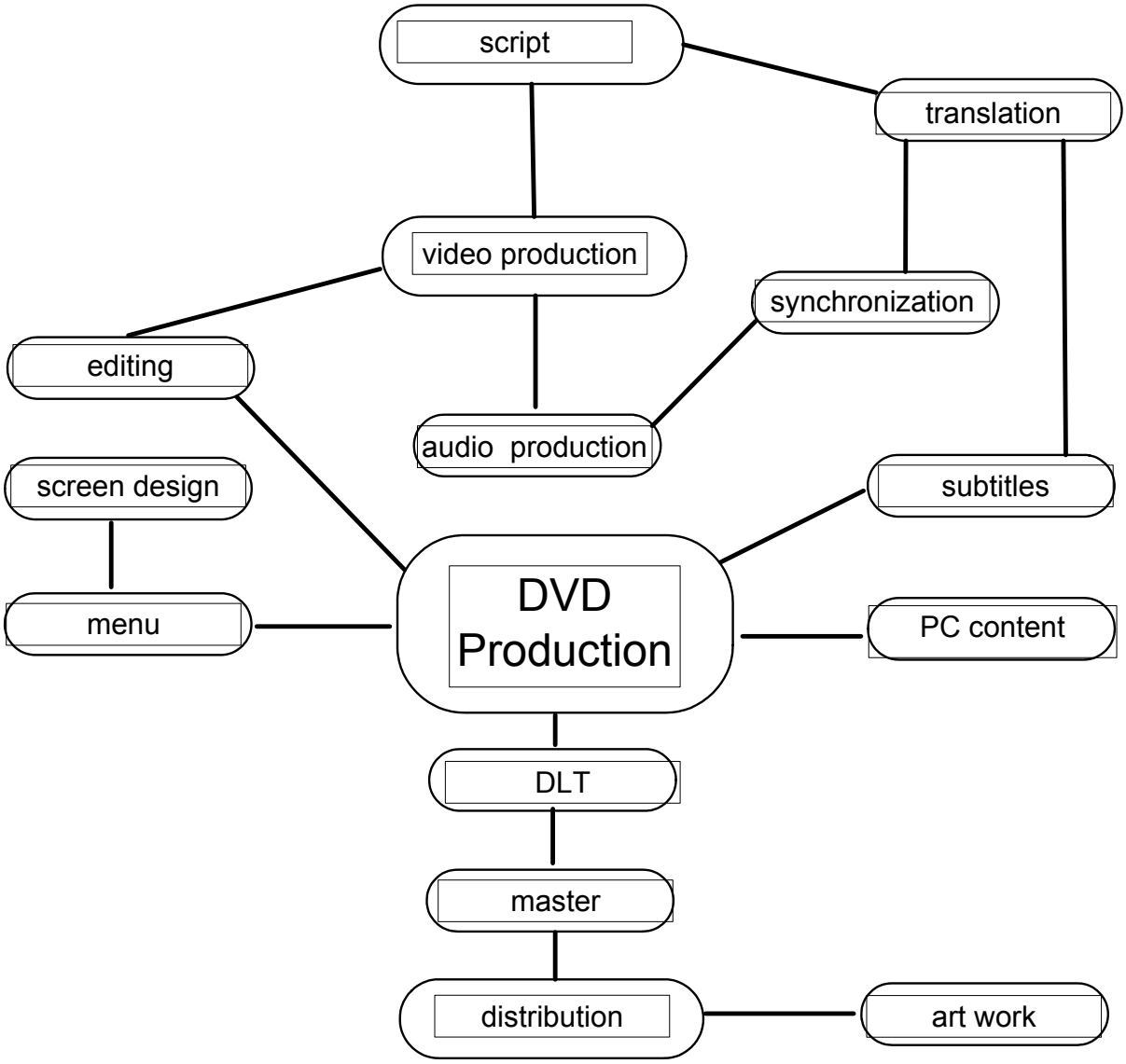
weblinks attached to menu-buttons

- Link to URLs

Integration of DVD-video-content with Html-environment

- Steering the DVD by scripts from a Website

4. Production of DVDs



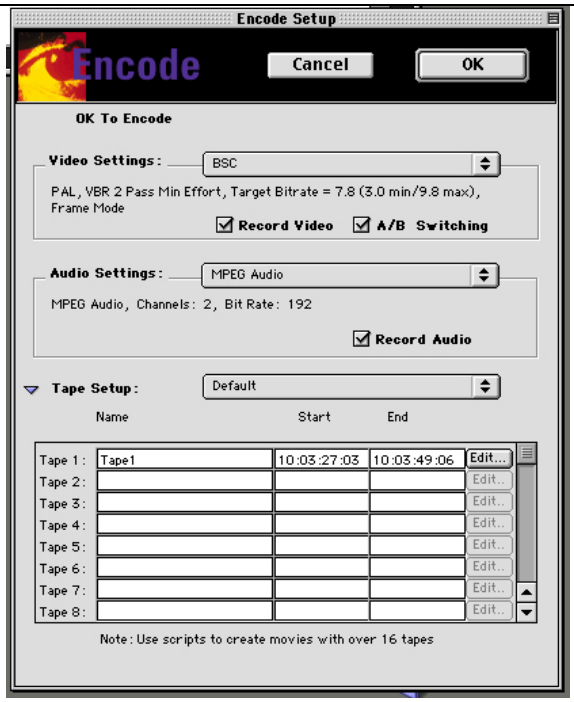
The workflow in producing a DVD is called “mastering” and includes a series of different steps:

(Screenshots are taken from editing the DVD “Von der Balanced Scorecard zum Performance Measurement)

concept (target group, available funds, duration of video, design of user interactions)

media preparation (e.g. video and audio recording, editing, graphics for menus, buttons, script for subtitles)

encoding (calculate bit-budget and then set coding parameters for audio and video)



parameter settings for encoding

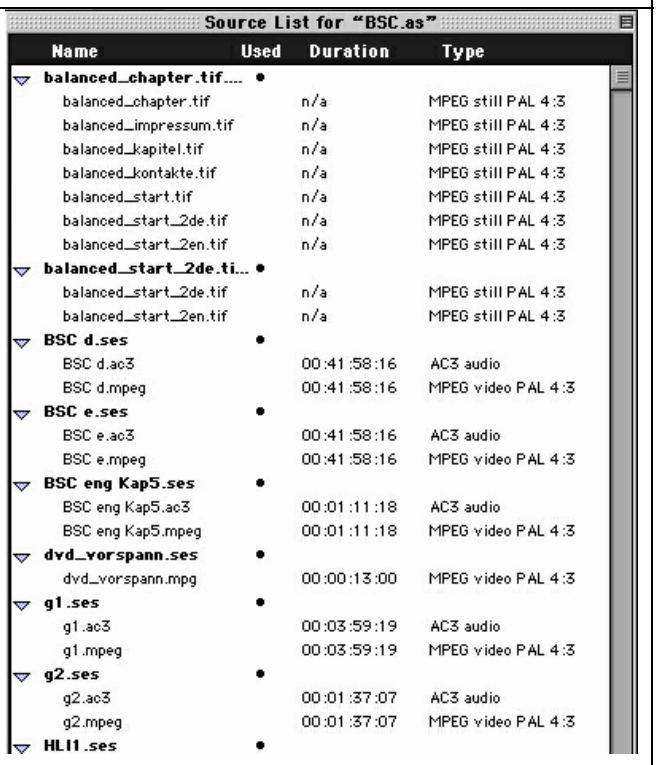
asset collection (import of source data (video, audio, graphics, subtitles etc.)

authoring

pre-mastering

mastering

distribution/sales



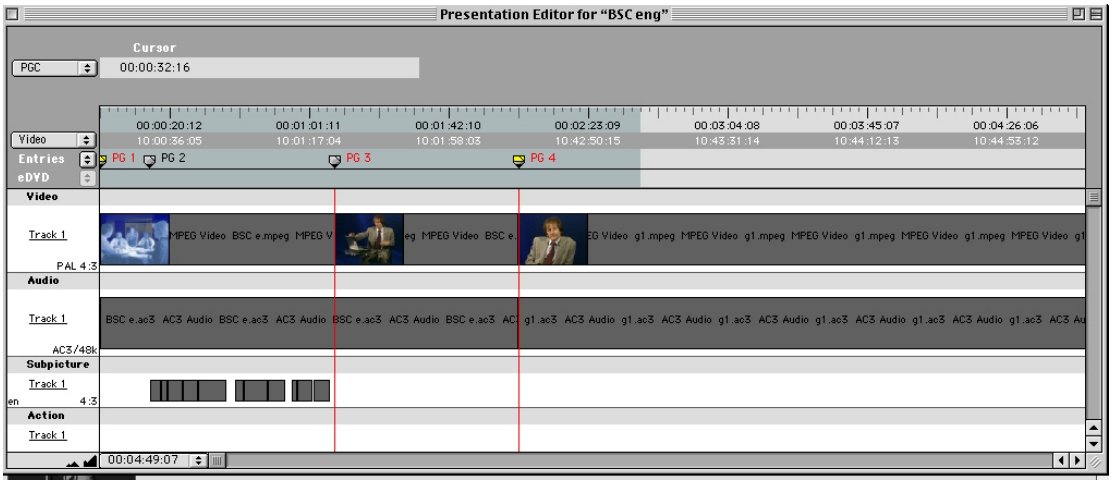
asset collection

The authoring process cover the following aspects (for the authoring we actually use Sonic Fusion)

Composing the tracks

- videotracks (camera angles)
- audiotracks (languages)
- subpicture (subtitles, slides usw

- setting of labels for chapters



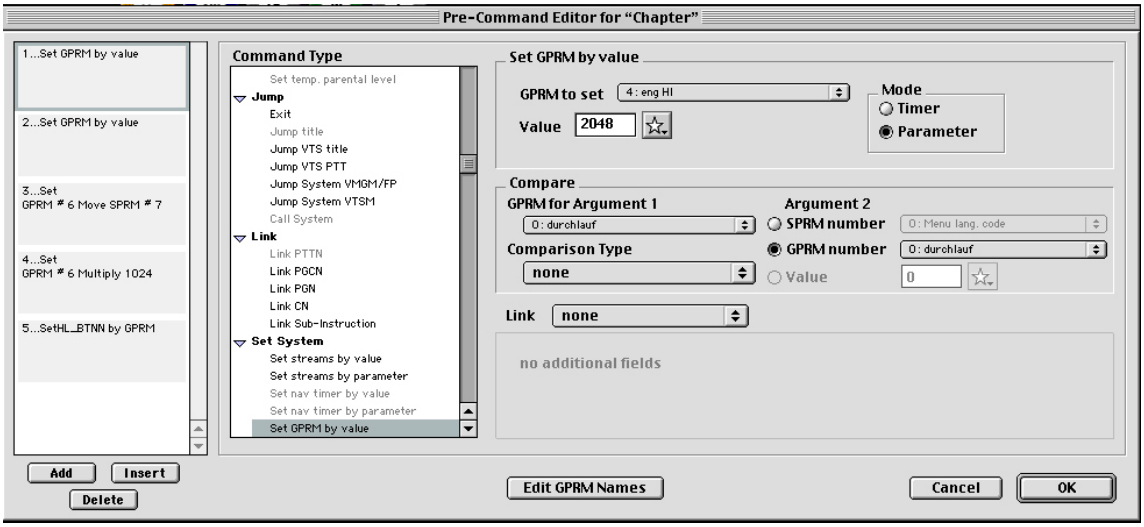
Timelines for video, audio, subpictures and actions

Graphics

- menu design
- background graphic or video
- highlight-Effects (Overlay)
- buttons

Programming

- jump commands
- „set audio / subpicture / angle"-commands
- timer functions
- random functions
- if / then - Routines
- programming with variables



Setting of parameters for highlighting a button for selection of a chapter in submenu "English"

5. Qualifications needed in DVD production

There are many different qualifications necessary in DVD production

In asset collection

- know formats and specifications
- video techniques
- audio techniques
- editing

In design

- graphic and screen-design
- 3D-animation

In encoding

- MPEG-2 videocompression techniques
  - data rates, field/frame, CBR (Constant-Bit-Rate), VBR (Variable-Bit-Rate)
  - bit budget
  - compression errors
- audio compression
  - Dolby Digital (AC3)
  - evtl. pre-processing
- quality control

in authoring

- creative programming
- knowledge of DVD-specification and syntax

6. The DVD "From Balanced Scorecard to Performance Measurement"

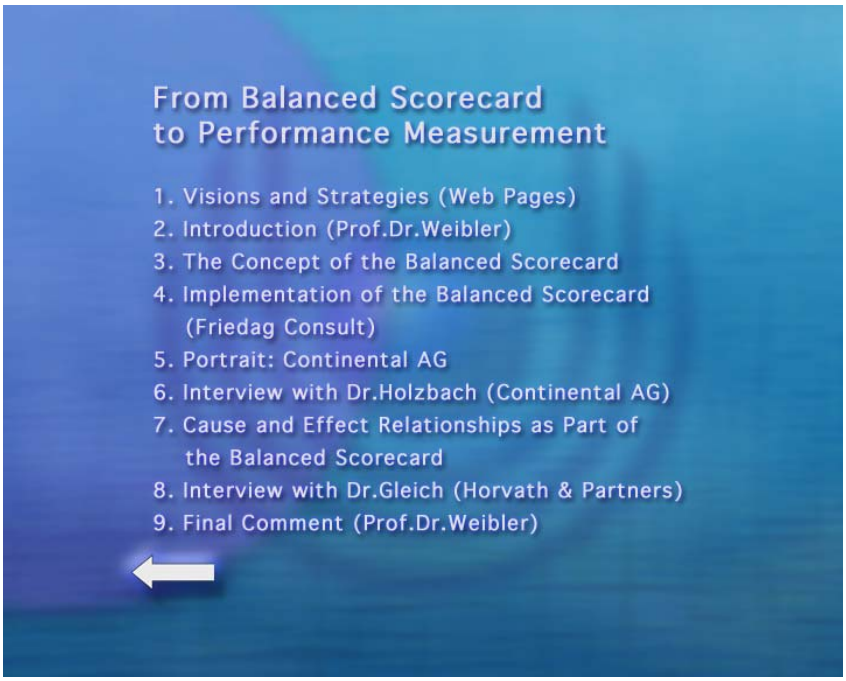
At FernUniversity Hagen a co-operation with a public TV channel exists already since 1983 to broadcast educational programs to supplement courses of different academic careers. The TV programs have been offered also as videotapes in VHS format. One of the TV transmissions in 2002 was a program called "From Balanced Score Card to Performance Measurement" that has been developed by the Centre for Distance Education Development jointly with the chair of Personnel Management and Organization at FernUniversität Hagen.

The DVD technology was chosen to provide students that have access to DVD players with excellent image quality. At the same time we wanted to offer the program both in German and in English language as multilingual teaching materials become every time more important in teaching (e.g. the faculty of electrical engineering and of computer science already offer bilingual Bachelor programs). In preparing the English version we found that it would be very costly to provide exact synchronization instead we used a voice-over presentation. However to make it smooth it is recommendable to give native speakers exact time duration for small chunks of text. Some internet video clips in German language that we could not re-edit have been subtitled in English.

The technical preparation followed the steps mentioned above:

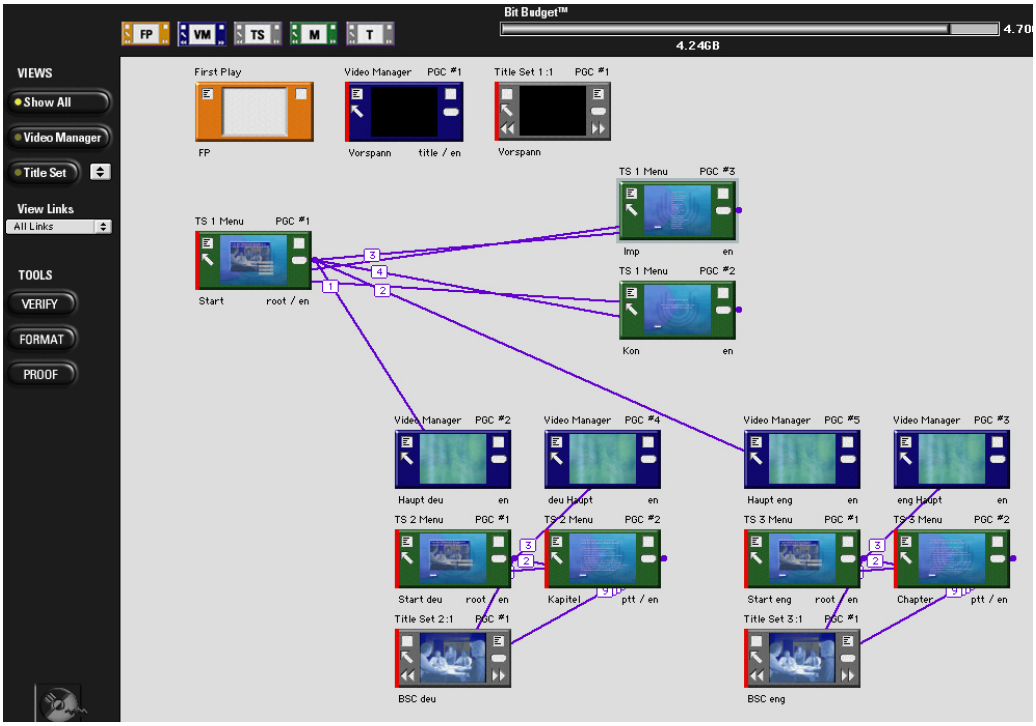
Subtitles, video-streams, audio-streams, graphics, programming

The user can switch between the German and the English version.



Chapters of DVD „From Balanced Scorecard to Performance Measurement"

As the production was structured in relatively short takes such as presentation of web-pages, statements, graphics with off-commentary and interviews we thought that it would be useful to access these takes as chapters also separately. The following menu structure reflects these options:



Structure of DVD „From Balanced Scorecard to Performance Measurement"

From the main menu the "impress" and "contact" pages can be accessed by buttons. The same holds for the two branches for the German and the English version. So in this case the menu structure is still relatively simple. However if the video streams are combined with more options then the branching can be rather complex.

7. Conclusion

The DVD provides the definite alternative to video cassettes. However technical production requires some additional and new qualifications as well as additional and different production tools. Also didactic settings remain widely to be still explored especially when combined with supplementary digital files of CD-ROM type. Furthermore DVDs still lack some more standardization and need more storage capacity. The standards DVD (4,7 Giga Byte) is actually not able to provide more than about one hour of video in good quality.

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