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CASLO: Collaborative Annotation Service for Learning Objects

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ABSTRACT

CASLO consists of a web service-based infrastructure and a client tool used to collaborate in making annotations to a learning object. Collaboration is provided through pluggable coordination protocols and evaluation strategies, as well as auxiliary services like version control, notification and tracing. CASLO is immersed into a more general collaborative authoring environment of learning objects.

1. Introduction

From the classic constructivist perspective, educational models should be focused on the active and participative role of learners for the construction of knowledge 4. Learning Management Systems (LMS) are key tools to support educational models, to encourage the active participation of learners, and to foment their responsibility in the achievement of competencies, whilst improving relationships between instructors and learners. Current LMS successfully implement learning object interoperability standards, but the integration of authoring and collaboration facilities are not tight enough to support the participative and creative roles that are required by a deeper constructivist view. Any constructivist approach implies furthering learners' involvement in the instructional process. In particular, different stakeholders can play their role during the creation of any learning material, including instructional designers, pedagogues, instructors, media designers, and even students 6. For this reason, support for collaboration in accomplishing the tasks involved in the learning object creation is welcome.

Authoring of learning material is not a matter of copy-and-paste chunks of digital media with added media design, but it is intended as the semi-automated composition of simpler learning objects in order to provide extended learning conveniences that do not exist originally. If automation is considered as a process in which the computer automatically and dynamically composes lessons, and whose result must have a pedagogical purpose, it becomes clear that the computer should have access to information regarding the design of instructional material 9. A set of formally modeled metadata allows incorporating instructional design rationales, among other relevant information, in a learning object that is being composed 7. Metadata can be used to describe, certificate, annotate, retrieve, extend or keep an updated history of a learning object. They can also provide an interpretation of the learning object resources for a machine-understandable layer (e.g. software agents, sophisticated search engines or web services) that facilitates their automated processing. Therefore, metadata are essential, not only to improve reusability of learning objects, but also as a key authoring task.

But metadata annotation is usually an arduous and not often attained goal, though metadata specifications are mostly mature, and a number of annotation tools are readily available. From our point of view, a major issue is how to provide learning objects with appropriate metadata annotations in order to increase the automation level for the composition of learning objects and services.

We took into consideration the previous rationales to design and develop CASLO, which consists of a web service-based infrastructure and a tool for the collaborative annotation of learning objects. CASLO can help a distributed community of experts, media and instructional designers, pedagogical advisors, and learners, to share the task of annotating a learning object. This tool facilitates collaboration on Learning Object Metadata (LOM)-compliant annotation by alleviating its centralization in a specific role.

The rest of the paper is structured as follows: Section 2 describes CASLO system architecture; Section 3 shows the required interactions to annotate a learning object, and illustrates it with a simple annotation case; finally, Section 4 outlines some conclusions and future works.

2. Overview of CASLO architecture

CASLO consists of two main elements, depicted in Figure 1. These are a back-end annotation server that behaves as the collaboration provider and a front-end gateway to the annotation services. Front and back-end communication is carried through the exchange of SOAP messages. The front-end part translates clients´ annotation proposals into the collaboration primitives of the back-end server, according to their WSDL published descriptions. The front-end client can locate the server and get an appropriate WSDL specification by searching in an UDDI directory.

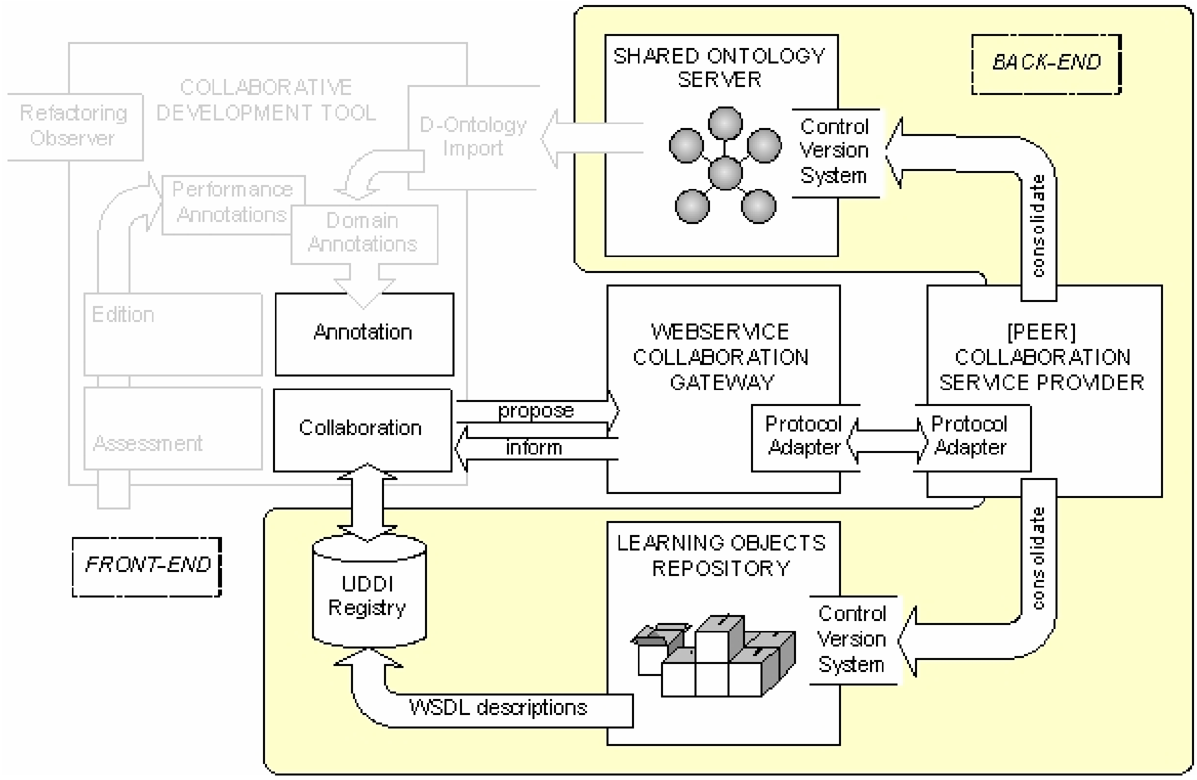

Figure 1. CASLO service-oriented architecture

2.1. Collaboration service provider

All annotations performed in CASLO are carried through the collaboration service provider. Therein, the main collaboration web service accepts annotation proposals before submitting them to the collaboration protocol. This service also allows defining projects, participants, discussions, assessment criteria, and timing parameters of the protocol. The current implementation uses a two-phase consolidation protocol, in which proposals are subject to peer evaluation before being consolidated into the manifest file 2. Nevertheless, the system design allows replacing the collaboration protocol with another desired implementation if required. Once proposals have passed successfully through the collaboration protocol, they are automatically translated into changes to the learning object manifest file.

A second web service monitors all pending tasks that clients must perform (for instance, to assess annotation proposals coming from other users). The reason to define such service is a lack in the current versions of UDDI protocol, which cannot track clients' operations in order to respond asynchronously from the server, nor initiate on the server an action over the client. Since this service is implemented apart from the main collaboration service, it can be substituted later, when UDDI versions evolve.

Finally, every annotation (either trial or consolidated) is automatically logged and version-controlled through its submission to the collaboration server. This way, an updated history of each learning object annotation lifecycle is kept, so it can be recovered to analyze the rationale or authorship of any annotation.

2.2. Access to collaborative annotation services

The access to collaborative annotation services is made through *Vizzini*, a thin client application that is used to propose, negotiate, and assess annotations on IMS-packaged learning objects. Since CASLO has been conceived to provide a general-purpose environment for collaborative annotation of XML files, the client has been easily adapted to work on learning object manifest files. Nevertheless, in order to author full-fledged IMS content packages, a more complete edition tool should be used. Currently we are providing this by integrating access to CASLO services into *Reload* editor 5. Nevertheless, all collaborative annotation functionalities can be readily tested through Vizzini.

3. Interaction with CASLO

The kind of information that can be managed with CASLO includes any XML file that can be validated against a given *XMLSchema*. In order to structure interactions and negotiations during a collaboration project, the following elements have been defined:

- *System*: the set of collaboration projects, registered users, and users' participation in projects—. Common users can try their own annotations, as well as to send assessments for annotations coming from other users. Users are associated to projects by the system administrator according to their roles. The project management is delegated to special users that act as project administrators.
- *Project*: the set of information artifacts (i.e. files and resources) that can be subject to collaborative annotation—. Each project is described by a main XML document file that provides access to its files and resources (e.g. in the case of learning objects, the main document is the manifest file).
- *Discussion*: the frame in which a concrete annotation decision must be taken—. Each discussion is related to an item within the main project file. All common users that are registered in the project can participate in any discussion.
- *Item*: any XML element that can be identified within the schema—. Such identification is currently done through *XPath*, although other mechanisms are also possible (e.g. *id* attributes).

Once the collaboration project is created, it can be parameterized with a given protocol and assessment strategy. Then, interaction between users can start, always according and restricted to the protocol rules. The collaboration proceeds until the protocol rules decide it has to (e.g. a certain degree of consensus was attained; all users achieved a certain level of participation, etc.)

3.1. User roles

Not all users have the same responsibilities in a project. Three main roles have been defined for project management purposes: system administrator, project administrator and common users. In turn, additional roles have been defined for user interaction purposes. These have been extracted from 2.3.1 attribute *role* of LOM base schema 3 —i.e. author, publisher, editor, graphical designer, technical implementer/validator, content provider, educational validator, instructional designer, subject matter expert, etc. Nevertheless, the set of roles is easily extendable to incorporate other specific roles.

3.2. A Case of collaborative annotation

There are a number of steps to be performed before starting a collaborative annotation. At least a collaboration project must be created, and a set of users must be registered in the system and the project. As well, the system administrator has to define a project administrator. The, the project administrator can choose the collaboration protocol, the timing parameters (e.g. typically hourly, daily, or weekly), and the evaluation strategy.

Considering that a valid manifest document is available to all the project users, the collaborative annotation can proceed as follows:

1. The initiator user locates the item she wants to annotate and starts a discussion. The system checks if the discussion can occur by assuring that there is no other active discussion on the same item.
2. If the discussion can be created, a configurable stand-by period is defined to allow users to propose alternative annotations. Although the initiator is usually the first in proposing annotations, she is not obliged to. After that period, if no proposals are received, the discussion is discarded without reaching an agreement.
3. Every proposal sent in a discussion is managed through the collaboration protocol. In the current version, every annotation proposal is passed through two phases: broadcast and consolidation. During each phase, the project users can evaluate the proposal or send alternative annotations. If there is no alternative proposal, a configurable timeout sets up the move from broadcasting to consolidation phase. But if there is any alternative, they are compared to each other, and eventually one becomes consolidated.

In any moment, each proposal can be in one of three states: consolidated, in-evaluation, or abandoned. Figure 2 shows an example resulting from the collaborative annotation of a learning object, which is an IMS-LD Level B example retrieved from OUNL DSpace repository 8. The upper right panel shows the content of the manifest file after a number of annotations that are made to select the correct answer to a question, through editing the corresponding property and condition. Such annotations were issued by different users, as shown in the lower left panel, which depicts the collaboration log. The proposal with id 3 is eventually consolidated, after submitting it to the protocol, and according to a given assessment strategy —in this simple case, the higher aggregated score of an annotation, the better evaluation it receives—. A more complete description of this and other examples can be found in *Sourceforge* 1.

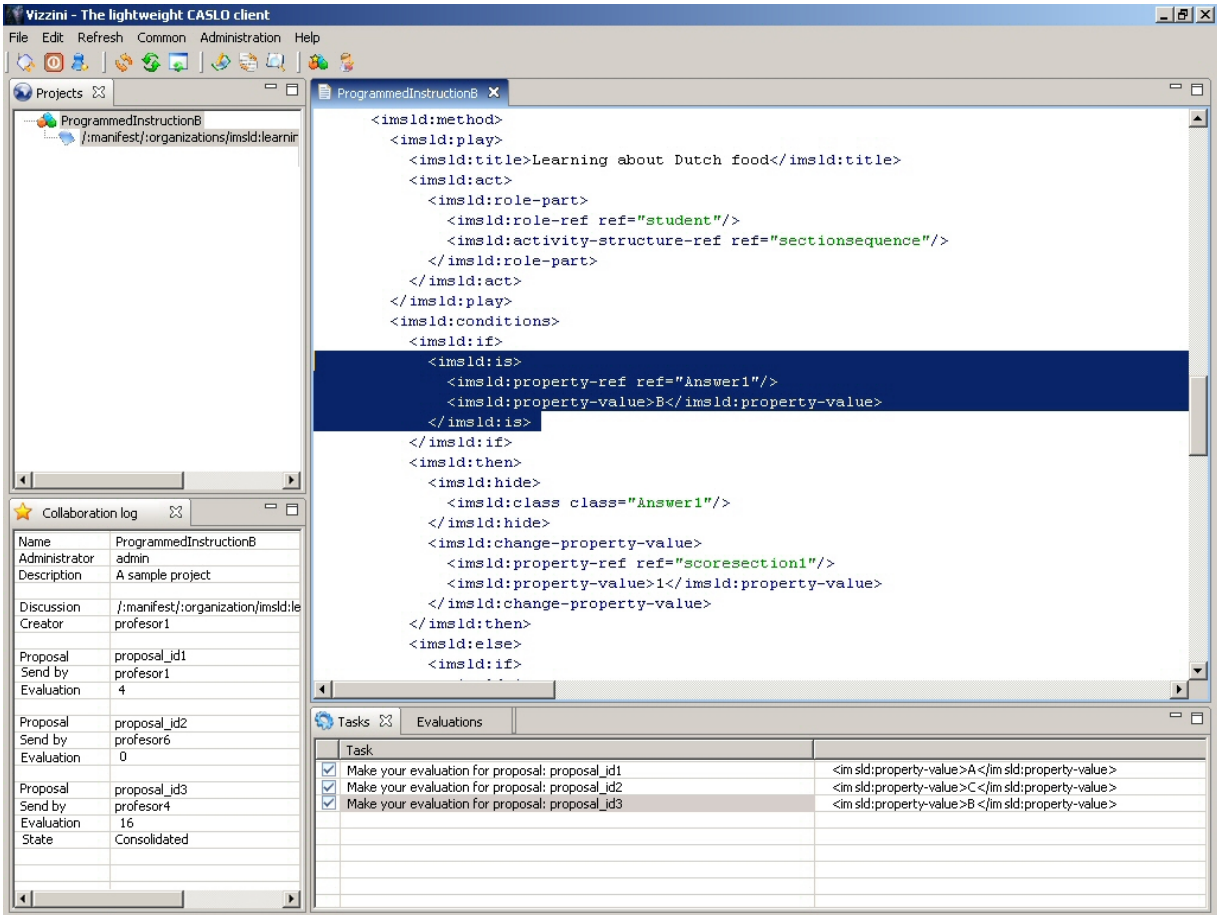

Figure 2. Example of a collaborative annotation with Vizzini, one of CASLO front-ends

4. Conclusions

In this work we presented a web service-based infrastructure and a tool for the collaborative annotation of learning objects. The aim of the collaborative approach is to facilitate the authoring and composition of learning objects, which is also a major objective of the MD2 frame project, in which CASLO is included.

The future lines of work begins by providing access to CASLO services from Reload, a major learning object authoring tool, in order to provide an authoring environment that is more complete than Vizzini. A further step is to integrate the CASLO collaboration facilities inside a model-driven development environment that can increase the automation level required to author and compose new learning objects.

5. Acknowledgements

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Carmen L. Padrón
Departamento de Informática
Universidad Carlos III de Madrid
carmen@dei.inf.uc3m.es

Juan Manuel Dodero
Departamento de Informática
Universidad Carlos III de Madrid
dodero@inf.uc3m.es

Jesús Lanchas
Departamento de Informática
Universidad Carlos III de Madrid
chechu@dei.inf.uc3m.es

Computational Sciences in Higher Education: "Have You Created Your Model Yet"

ABSTRACT:

Computational Science software is available that supports an understanding by students of computer modeling, visualization, and computational sciences at all levels. The presentation will demonstrate computational science models that assist students in building understanding in their classrooms, develop systems thinking and computational concepts, and use visualization techniques.

With the publication of The Fifth Discipline in 1990, learning organizations and systems thinking have become buzz words in our society. BUT, these are not just buzz words anymore. They represent concepts in which people continually expand their capacity to create results that are truly desirable, in which new and expanding patterns of thinking are nurtured, collective aspirations are set free, and people learn how to learn together. In short, collaboration is used to help students learn how to think and build understanding.

According to the author Peter Senge, the five disciplines are personal mastery, mental models, shared vision, team learning, and the fifth discipline, systems thinking. Systems thinking makes the results of the other disciplines work together for the benefit of the organization (Senge, 1990).

Systems thinking is nothing new. The framework of the concept has been developed over fifty years, and its essence lies in a shifting of the mind from linear cause and effect chains to visualizing interrelationships, and from observing snapshots of change to viewing change as a process. Barry Richmond, while an Engineering Professor at Dartmouth College, founded High Performance Systems, Inc.(now referred to as *isee systems*), in 1984. His mission was to make the world a better place by increasing people's capacity for thinking, learning, communicating, and acting systemically. Richmond defines thinking as consisting of two activities: "constructing mental models and then simulating them in order to draw conclusions and make decisions." (Richmond, 2001). These activities are assisted by contemporary computational science software, such as STELLA and AGENTSHEETS, and may be used in education to help students build understanding and move away from a linear chain toward visualizing inter-relationships. The software gives people a powerful tool to generate insights, such as unintended consequences of an action or policy, and then to be able to try out different scenarios on a simulated practice field. Making mistakes on practice fields is a lot less painful, costly, and embarrassing than making them in real life, according to Richmond.

What the software also does is eliminate the need for students to create the mathematical formulae to solve the linear equations that create the computer models – the software does it for them, in the background, and may be viewed by selecting the appropriate link at any time. This has lead to a controversy regarding the appropriateness of such a method that purports to teach students how to think. Does removing the need to create the correct mathematical construct also inhibit the process of understanding?

Since computers enable human beings to perform calculations without actually performing calculations, there has been a debate regarding the erosion of that capability. Doctoral dissertation candidates routinely run complicated statistical tests without the need to use a calculator or the proper formulae to arrive at accurate results. When the United States Army Field Artillery School began teaching students to use a computer to solve the "firing problem," or trajectory algorithm based on ballistic firing tables, instead of teaching the manual method, a hue and cry erupted from the purists who insisted that students continue to be taught the old manual methods in order to understand the process in case the computers did not work.

As we move into the 21st Century, the argument may be made that it is just as important to teach modeling and visualization of concepts as it is to pour mathematical knowledge into the heads of students. "Modern science and mathematics are more concerned with pattern recognition and characterization (http://www.shodor.org/interactivate/activities/rabbits/index.html) than with mere symbol manipulation (http://www.shodor.org/talks/modeling/reality.html). Teachers and students have found that computational science enables them to understand a broad range of phenomena that are otherwise inaccessible. This includes phenomena that are too small (atoms and molecules), too large (galaxies and the universe), too fast (photosynthesis), too slow (geological processes), too complex (automobile engines), or too dangerous (toxic materials) to be studied in the undergraduate laboratory." (Panoff, 2003).

A new generation of students lead by forward-thinking faculty are now learning how the tools of computational science- interactive numerical simulations, scientific visualization, and computer assisted algebra systems and data mining- may be incorporated into the classroom. The computational sciences education movement is evidence of this, as grant funding from the National Science Foundation supports the endeavor. Thus, the systems thinking software demonstrated in this presentation enables students to achieve the goals of developing understanding and pattern recognition as opposed to the rote memorization of mathematical symbols so soon forgotten after the Final Exam.

A team of faculty and technology support professionals from the Dunwoody Campus of Georgia Perimeter College participated in the National Science Foundation-sponsored Education Program of SuperComputing 2002 in Baltimore, MD. The emphasis was upon improving and encouraging the use of computational sciences (using computers to teach) in minority-serving, undergraduate, two-year colleges funded by the $2.75 million dollar NSF grant. Workshops followed over the last two summers for Dunwoody Campus and other GPC faculty. The college's Center for Teaching and Learning became involved shortly thereafter, a key to making this a college-wide initiative. At the college's annual Math Conferences for 2003 - 2005, the National Computational Sciences Institute was represented by participants making presentations and, in 2005, delivering the keynote address. Georgia Perimeter College has gained initial national visibility for implementing the computational sciences in a multi-campus environment.

The College is now entering into a national partnership with NCSI and six other institutions in order to get a deeper understanding of the important issues that surround undergraduate computational science education. The only way to get inside the issues is to see first hand how computational science is being incorporated at specific institutions. This can include a wide spectrum of activities from using pre-constructed models in a course to illustrate concepts (the most common type of computational science education activity we have seen from our data), redesigned courses with new curriculum components or labs, new computational science courses, new computational science programs (concentrations/majors/minors), educational partnerships with industry/organizations/research groups, outreach endeavors, etc. (Searcy, 2004).

What the GPC/NCSI research partnership hopes to accomplish is to develop a national community of undergraduate faculty interested and involved in computational science incorporation in their classrooms, and have NCSI workshop participants incorporate computational tools, techniques, and technologies into their teaching. Of utmost importance is the opinion of students. The research will consider their perceptions of the computational tools, techniques and technologies they have used in class (even if they may not have any idea about "computational science"), and their feedback about using models or technologies to understand concepts in their courses. It is important to know what they are thinking about the world in which they will soon be employed and whether or not they think the skills they are learning now will be useful later. (Searcy, 2004).

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Alan N. Clark, Ed.D.
Director of Technology and Media Group
Georgia Perimeter College
Dunwoody Campus, Atlanta, GA, USA
Tel: +1 770-551-3053
aclark@gpc.edu

Modeling Learning in simSchool

Introduction

Interest in games and simulations in teaching (Prensky, 2002; Aldrich, 2004), and the potential for network-based assessments (Stevens, 1991; Stevens, Lopo & Wang, 1996; Dexter, 2003; Gibson, 2003) has led to developmental research on "simSchool," a simulation for teacher education. This paper outlines how theoretical frameworks for leadership, learning theory, interpersonal psychology and behaviorist teaching models are being combined into a new synthesis model of classroom learning in simSchool. The model controls how the simulated students learn and behave in response to task, teacher and peer interactions and provides a complex multicausal network of relationships for experimenting with teaching approaches.

A "flight simulator" for teaching

The goal of SimSchool is to provide a realistic and safe practice environment – like a flight simulator for a pilot - for users to develop skills in differentiating instruction, managing a classroom, and adapting teaching to multiple cognitive abilities and special education needs. Future teachers and anyone interested in improving teaching see thesimSchool classroom from the "first person" view of a teacher when experimenting and playing. The simulator works by linking many variables into three broad concepts: the student's personality, teacher moves, and academic and social behaviors of students.

The personality frameworks, which include the Five Factor Model or "Big Five" (McCrae & Costa, 1996) and the Myers Briggs Type Indicator model (Myers, 1998), define the emotional and behavioral dimensions of the students. Teacher moves include planning and choosing tasks and making "in flight" decisions while class is in session. The model for student academic behaviors (e.g. performance on tasks) has drawn from theories of intelligence and learning theories informed by cognitive science (e.g. (Festinger, 1957; Bloom, Mesia & Krathwohl, 1964; Gardner, 1983; Bloom, 1984; Piaget, 1985; Lave & Wenger, 1991; Perkins, 1995; Bransford, Brown & Cocking, 2000). The social behavior dimension of the students is defined by the Interpersonal Circumplex (Leary, 1957; Kiesler, 1983) mediated by a model of conversational leadership (Lambert, 1995) and social expectations states theory (Cohen & Lotan, 1997). The simulation proceeds from state to state through interactions within and between the components of the student personalities, the task design and teacher interactions, and each student's social responses within bounds suggested by and determined by these theoretical frameworks.

simStudent Personality

Underlying the simStudent personality, a computational model determines how each student independently behaves in the classroom. Each student has a unique profile that includes their history, academic performance, their social and emotional characteristics. In addition, as the user works with a student over time, the history of the profile changes. The student's personality is made up of three components, Traits and Needs, Learning Preferences, and Social Expectations. Students have any number (in the trillions) of combinations of these factors and these determine what a student does during teaching (e.g. how they act and what they say in class) and how they perform when prompted (e.g. on performance-based and limited response assessments).

Social expectations settings, for example, determine how the SimStudent reacts when the teacher interacts with other students in the class, and how the SimStudent acts when in a small or large group. Planned additions in this area will take advantage of (Cohen & Lotan, 1997) observations about the state to which a student is driven by expectations of a group about potential contribution to the group's success. To indicate student responses, students change their posture at their desk (e.g., falling asleep or raising their hand), respond verbally ("I am trying really hard to complete my work"), and display results on performance assessments.

Teacher Moves: Task Design & Verbal Interactions

Task Design processes in SimSchool adhere to standards-based teaching practices and are based on theories such as "Teaching for Understanding" (Wiggins & McTighe, 1998) and assessment approaches that measure alignment of performance with the demands of a task or an assessment prompt (Shannon, 1999). The tasks design features include cognitive load (Sweller, 1988) of the content as well as loadings concerning the social, emotional and physical requirements of a task.

Task design elements may have direct or indirect and complex relationships to a student's personality settings on the Big Five (e.g., extroversion) and to the Interpersonal Circumplex (e.g. dominant; see Figure 1). If the instructional level of the task is below the student's ability, the student gets bored and performance suffers; if above their ability the student gets frustrated and performance suffers and if the task falls within their zone of proximal development (ZPD) (Vygotsky, 1962; Vygotsky, 1978) the student's performance is enhanced.

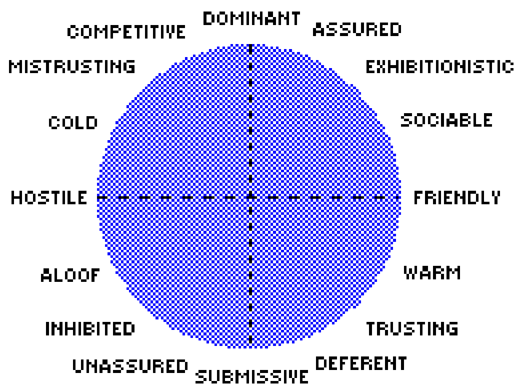

Figure 1. The Interpersonal Circumplex

Teacher-to-student (and vice versa) verbal interactions take place within the Interpersonal Circumplex (Figure 1), which uses 16 categories arranged along two axes: dominant – submissive and hostile - friendly. Teachers choose statements that represent positions on the circle, and students respond based on their current states, immediate past history and the theory of interaction expressed in the Circumplex Theory. Teachers, through their choices, will decide whether to reinforce the student's actions positively or negatively.

Other teacher moves include "pre-flight" and "in-flight" decisions that a user can make, such as arrangement of students in the classroom or whether to lecture or do hands-on activities. In-flight decisions to change tasks, groupings, and to interact personally with a student or group, intersect with the individual personality and academic characteristics. Teachers can learn about students from "student files" as well as by watching classroom behavior and considering the measured academic performance of students in response to the planned tasks and classroom actions. Replay and display screens are planned to enable reflection, fine tuning of actions and to document the growth of teaching skills over time.

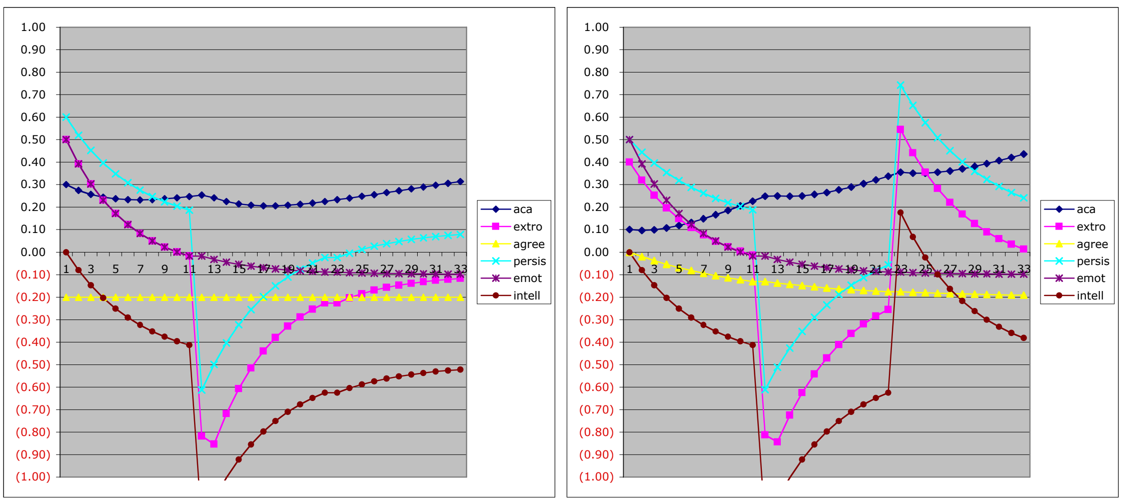

Figure 2. Complex behaviors emerge as variables are added.

The combination of these elements creates complexity through the structure of tasks, the student's personality, and neighbor interactions. As a result, complex behaviors begin to emerge (Figure 2). Multiplying the individual complex behaviors over time by the number of students in a classroom produces a "game" in which the only choice is to develop skills of differentiating and individualizing instruction in order to maximize outcomes for all students.

Conclusion

SimSchool is designed to be a small window into the complexities of teaching. It is an environment for aspiring teachers to practice making decisions about planning, task design, and responding to students with complex personalities and cognitive profiles. Initial research and testing shows promise for creating a "flight simulator" for teachers that models some of the complexity of real teaching.

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David Gibson
dgibson@curveshift.com

Testing an interactive lecturing technique for teaching

An interactive method of teaching and learning was tested in the preclinical course of basic pharmacology. The method was based on an Interactive Presenter multimedia presentation system combined with a soft ware for interactive audience feedback and analysis. One of its main features is an audience polling system. This gives a possibility for the teacher to ask students questions and receive their answers during teaching. The response can be received and analysed immediately. Furthermore, the answers can also be analysed and shown immediately.

Therefore, the teacher would have a possibility to evaluate students learning already during teaching. This gives also a possibility to change the content and methods of teaching in order to affect on the learning results. E.g. based on the immediate response, the teacher may repeat something very important, concentrate on something essential, and perhaps decrease or increase the content or level of teaching. This system also makes it possible to follow that the students are paying attention on the teaching. In general, the teacher can use this method to activate and motivate students and learning, too.

In addition, the Interactive Presenter system was tested in the multiple choice examinations. In practice, the questions are first given to the students and they have some time to prepare for the answers. Next the answers are collected using Interactive Presenter Audience Polling System. The students are making their choices, and the answers are analysed. Then, the results are shown after the examination. Now, the teacher can go through the answers, explain the right answers and background for the questions. With this feedback, the teacher may change the examination towards a real learning situation more than having just a specific examination. This practice may have several advances for teaching, e.g., by promoting cognitive and constructive active and interactive views of teaching and learning.

This paper describes some plans and experiences about the use of the interactive method for the contact teaching and for the multiple choice examinations. Our aim is to develop a novel Interactive Presenter-based 'On site'-model for teaching and learning. The use of the interactive teaching and learning method will be tested and studied. An example of using this method for teaching molecular biology to students of pharmacology is described. The results are discussed especially in relation to tutoring, orientation, evaluation and response of teaching and learning.

The Interactive Presenter can be used for the immediate analysis of students and audience in different ways. Some examples of the questions are enclosed here.

I. Analysis of background: where are the students coming from?

I am participating the present course as
1) a 1st year student of medicine
2) a 2nd year student of medicine
3) a student of another field
4) nothing of the possibilities

II. Analysis of activity: do the students participate in optional examinations?

Do you participate in the optional examinations?
1) allways
2) sometimes
3) never
4) not decided

III. Analysis of basic knowledge: how much do the students already know?

Have you already studied pharmacology earlier?
1) I have a basic examination in pharmacology

2) I have studied some pharmacology by my self
3) I have never studied any pharmacology

IV. Analysis of specific knowledge: what is the starting level of students to study biotechnology?

What is not true for biotechnology?
1) biotechnology is already a very old field of human activity and history
2) biotechnology is actually another name and synonym for gene technology
2) biotechnologically produced recombinant proteins are used to treat diseases
3) biotechnological drugs should also undergo pharmacological investigations

Here, the Interactive Presenter system can now be used to answer the questions and analyze the answer immediately. Then, the analyzed data can also be presented for specific questions and students either in groups or even individually. The results can be shown as personal results or anonymously. The software calculates the results per cent of each answer and shows these results as a summary for each question. The results can be first shown as such without indicating the right or wrong answers. Then, the right answers will be highlighted. Therefore, after presenting all the answers, it is possible to continue by immediately explaining the background for right answers. The information from students and audience can be used as an orientation to find out the correct level of the course for further teaching and learning. In this way, it is also possible to use the IP system during the teaching to follow how well the learning has progressed, and therefore to repeat something important or to move forward to more difficult or new issues. Moreover, the IP-system could be used to change the common lecture to an interactive method of teaching and learning. An additional advantage of IP system is that the data from the teaching and learning can be saved in the computer for further pedagogic analysis. This gives the possibility to effectively use the learning results for the development of teaching in the future, too.

Atso Raasmaja
Division of Pharmacology & Toxicology
Faculty of Pharmacy, P. O. Box 56
FIN-00014 University of Helsinki
Finland
Atso.Raasmaja@helsinki.fi

ubiNEXT: Exhibition Guide System that Supports Visitor's Learning Experience in Museums

1. Introduction

Museums, including art, history, natural history, science, zoos, aquariums, historic sites and arboretums, strive to facilitate the learning experience of ever-increasing diverse audience. The number of museum visitors has increased in the past twenty to thirty years (Falk and Dierking 2000, p. 219). In order to meet the diverse visitor's needs, some museums are applying advanced information technologies to museum multimedia guides and developing the prototypes (Wilson, G. 2004). We designed an educational museum guide called ubiNEXT (ubiquitous Networked Exhibition eXplore Technology) to enhance visitor's learning experience in museums.

2. ubiNEXT

ubiNEXT provides visitors with Internet and on-site services. The Internet service has two major features, a pre-visit planning and visit review. Pre-visit planning is designed for school teachers and visitors, who would like to personalize their tours before entering a museum. Visit review offers visitors to continue their museum experience at home or in the classroom. At the museum, the PDA presents object information and educational activities, with interactive text, audio and video. It also presents object locations. When the visitor scans the barcode of an object with the PDA, the related interactive content is accessed from the server through the wireless network and displayed on the screen.

3. The Feature of ubiNEXT

As a step further from audio guides and other exhibition guides available at museums, the PDA provides visitors a number of object recommendations in which visitors may be interested in seeing subsequently.

Recommendation is determined by two major factors. One important factor is the allocation of keywords to each object. The system assigns several keywords, such as sculpture, Impressionism, and mythology to each object. If, for example, a visitor was looking at Vincent van Gogh's "Sunflowers" which includes a keyword "Impressionism," ubiNEXT will automatically suggests Claude Monet's "Water Lilies" which shares the same keyword. Such keywords virtually connect different objects exhibited in multiple galleries. The information content presented on the PDA changes dramatically according to each keyword. Thus, it allows visitors to encounter various stories or find different perspectives based on individual keyword.

Another significant factor that contributes to the recommendation is visitor's personal preferences. After learning about objects shown on the PDA, visitors have an opportunity to express their evaluations on each object. Then, ubiNEXT will give the recommendation to visitors by calculating visitors interests based on their personal evaluation, previous browsing of objects and the physical distance between objects displayed. For instance, if a visitor gives a high rating on objects that have a keyword, "Impressionism," ubiNEXT will provide the visitor a tour that includes objects containing the keyword, "Impressionism." ubiNEXT makes it possible for visitors to experience a tour that matches their interests.

4. Pilot Study

We conducted a pilot study at the Kyoto University Museum, Kyoto, Japan, to evaluate how ubiNEXT supported visitor's learning experience. The study continued for a period of twenty days in December, 2004. The experiment focused on the PDA tour at the museum. The exhibition in which PDAs were tested was a temporary exhibition about the history of the Faculty of Engineering at Kyoto University and its contributions to the society. We prepared the content materials for ubiNEXT, including object explanations, educational quizzes, object images and videos. Our target audience was children around ten years old.

We asked visitors to rate ubiNEXT by answering several questions on a questionnaire. Among 328 visitors of individual and groups who used ubiNEXT, 142 visitors returned the questionnaire. Among those who answered the questionnaire, 114 visitors were over 19 years old. The rest, 28 visitors, were children and youth from 7 to 18 years old. All 142 visitors rated the following questions that particularly focused on their learning experience based on 4 scales (1=Extremely, 2=Little, 3=Not much, 4= Not at all.)

Q1: Did you discover anything new at the exhibition with ubiNEXT?
Q2: Did your interest level on the exhibition increase with ubiNEXT?
Q3: Did ubiNEXT allow you to look at the objects in depth?

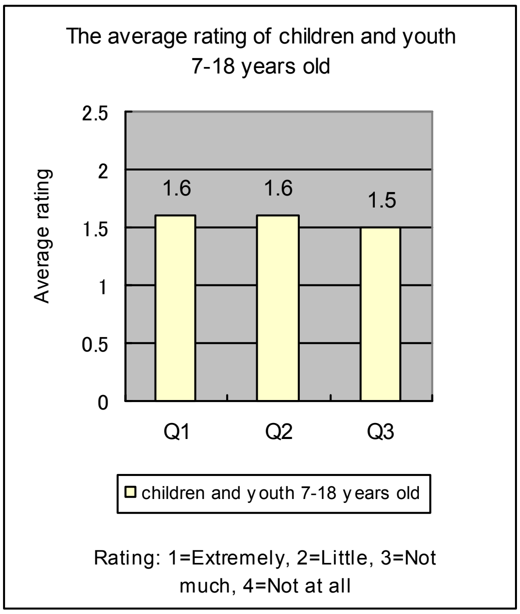

Figure 1: The average rating of adults over 19 years old

We divided the questionnaire results according to the age group. Figure 1 shows the average rating of adults over 19 years old and Figure 2 shows the average rating of children and youth 7-18 years old.

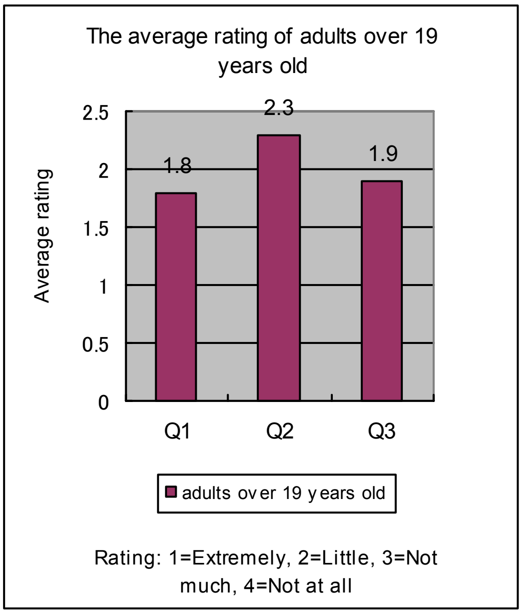

Figure 2: The average rating of children and youth 7-18 years old

There was a significant difference between the age group of visitors over 19 years old and visitors 7 to 18 years old. Overall, younger visitors 7 to 18 years old gave a more positive evaluation on ubiNEXT than adult visitors over 19 years old. ubiNEXT provided a better learning experience for the younger visitors. Some of the factors that may have influenced the difference were adult visitor's previous knowledge about the exhibition, the content materials targeted for children, and young visitor's unfamiliarity with the exhibition content.

5. Conclusions

We introduced the museum exhibition guide system that was particularly designed to support visitor's learning experience. We also discussed the pilot study at the Kyoto University Museum. We prepare to carry out an experiment at a modern art museum in the Netherlands in May 2005 to further research on the effectiveness of ubiNEXT. In particular, we will examine how dynamic object recommendations can motivate visitors to discover multiple perspectives about objects. In addition, we seek to find out how the personalized tours correspond to visitor's interests and hence, enhance their learning experiences. Finally, we evaluate how the two features of the Internet service support visitor's actual visit in the museum.

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Aya Masuoka, Toru Takahashi, Takugo Fukaya
Advanced Telecommunication Research Institute (ATR)
Media Information Science Laboratories
amasuoka@atr.jp
toru@atr.jp
tfukaya@atr.jp

Machi Takahashi
Advanced Telecommunication Research Institute (ATR)
Intelligent Robotics and Communication Laboratories
machi@atr.jp

Intelligent Agents: a New Paradigm to Support Collaborative Learning in Distance Education Systems

Introduction

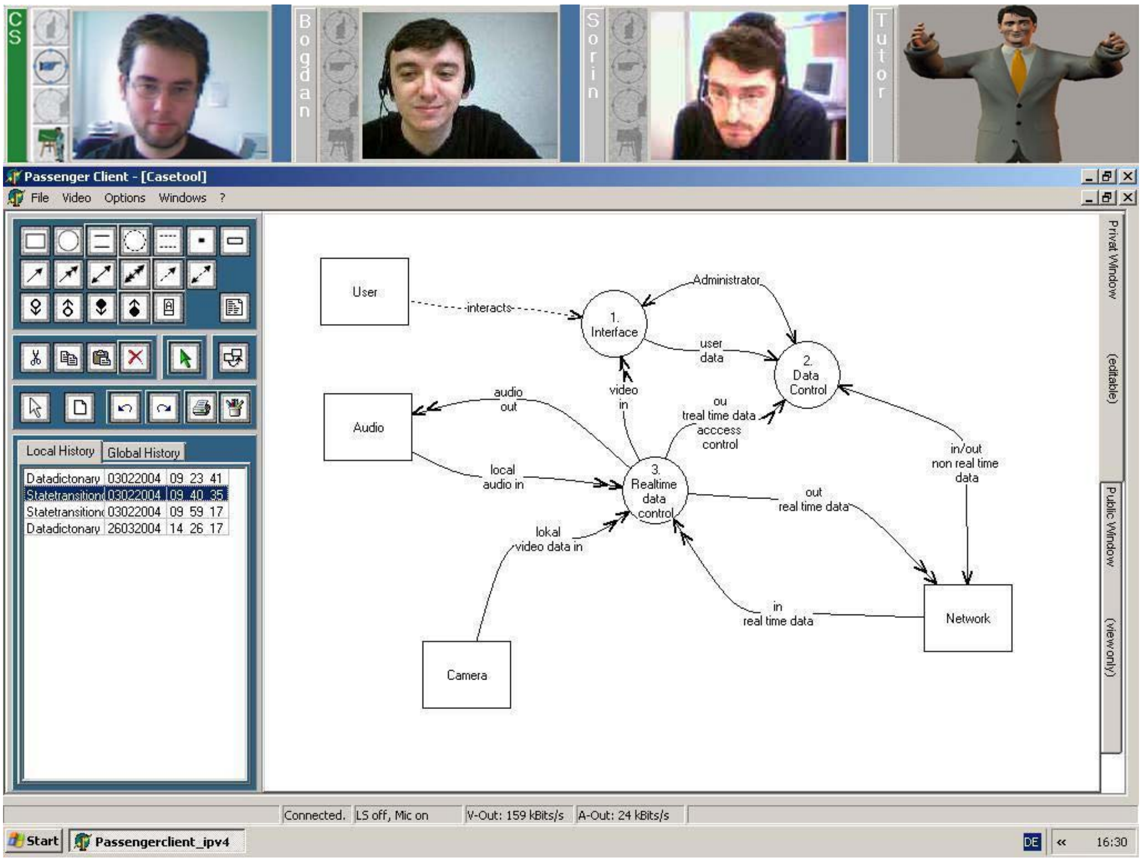
Current distance and open learning devices attempt to reduce the difficulties encountered by learners when they follow a distance course. In particular, laboratory experimentation/practice is inconvenient because the students have to be physically present in the university laboratories. In local laboratory experiments, students usually work together in groups of two or more. This learning paradigm is often called collaborative learning. One solution for this problem is usage of virtual collaborative environments which bring together users geographically dispersed but connected via a network.

Another inconvenience in distance education is tutor's difficulties when he follows a distance collaborative learning process, and in particular those participants who cannot keep up progress with their group mates. A solution to overcome this inconvenient can be smart agents which can partially replace a human-tutor in the collaborative learning process of distributed student-teams.

Implementation

A synchronous groupware named PASSENGER was developed at University of Duisburg-Essen throughout the last years. This groupware is a distributed application for participants in partially not foreseeable places. The system was designed to support collaborative learning activities and especially for the usage in Software Engineering – Education.

The Passenger-Client (see bellow) consists of a communication component, a cooperation component and several shared tools and resources to carry out Software Engineering tasks. It contains video screens of each member and a whiteboard that is divided in a public window for common process on the outline documents and a private window for individual process on the documents.



Each member has the same view of the public window according to the What You See Is What I See (WYSIWIS) principle, but only one of them can alter the document at a certain time. Each member is also equipped with a private working window to try out own ideas and to work simultaneous on an individual solution. The client interface has also a function which permits a member to transfer the content of the public window into its own private window.

Passenger Floor Control (PFC) handles the access to shared resources and coordinates the course of communication via the administration of different kinds of permissions, e.g. permissions to speak, permissions to alter the documents etc.

The creative tasks within the collaborative group processes, respectively the modification of the common artefacts take place in the common work area. The Public-Window area of the Whiteboard is managed by the PFC.

A Telepointer serves to elucidate and present the facts. The Telepointer is implemented as a collaborative service which can be used by the Floor-Holder. This user can lead the attention of the other participants to some objects or screen areas of the public window during a discussion.

For the aspects of group awareness, each participant is always placed into the same video screen. Each participant appears always in the left corner of its own screen. The Tutor (agent or human) is always in the right corner. All other participants are associated to a fixed position with the help of an ID-number assigned by the Passenger Server. If a participant is missing, the associated position is empty.

Group awareness functions are implemented by means of providing all needed information for a late coming in participant to discover the actual conference state. This is implemented by highlighting the video screen of the person who has access to the shared resources.

We integrated animated-agents in Passenger in order to overcome the lack of tutor when the students meet outside tutor working's hours. We consider agents in a virtual society of learners as entities that occupy a social position and perform several roles. To exemplify the concept in our environment the tutor-agent should have besides the tutoring-roles like:

- *Interrogator* – poses questions and the students of a collaborative group then provide answers. The questions should provide help for the students to reach a common learning goal.
- *Reviewer* – analyzes the students' answers, including whether it is correct or not.
- *Monitor* – records the answers from all the students and the communications among students during the collaborative learning process.
- *Instructor* – gives individualized instructions and helps those students who cannot keep up with the progress of their group-mates.

also:

- *Group Manager* – controls the coherence of the group. For this role agent's requirements are: to monitor the owners of the PFC, to control the PFC access grant/take the PFC to/(from) the inactive users. Also it must assure a fair distribution of PFC among participants in a learning session. This role tries to solve one of the open problems in the collaborative virtual environments: communication issues among participants.

Results

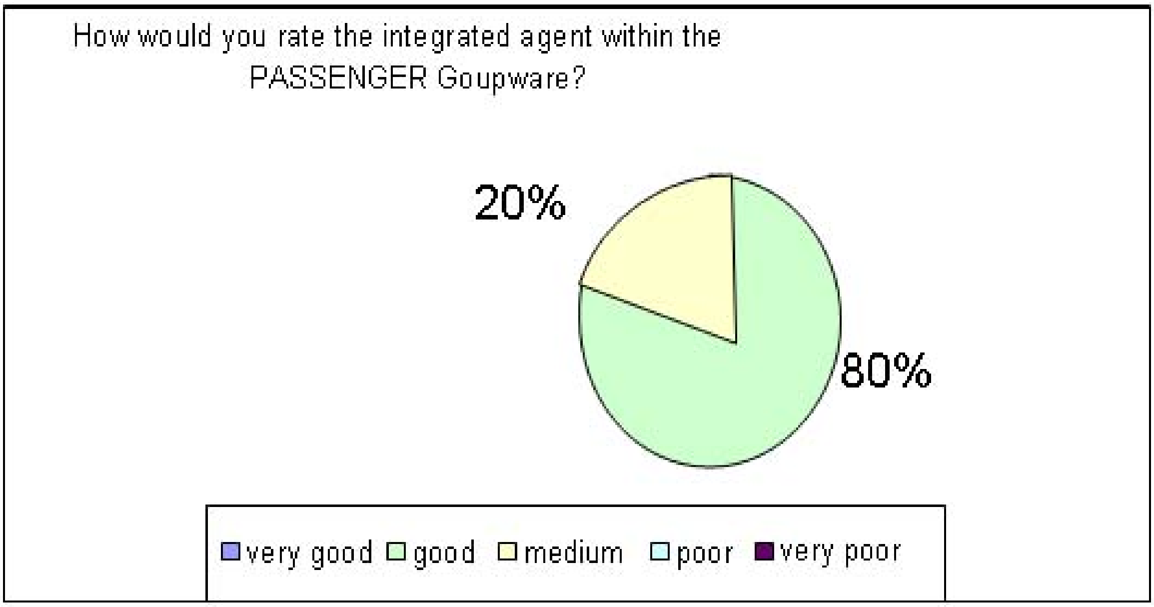
The evaluation study concerns two levels:

- Usefulness level: the usefulness of the agent facilities within Passenger groupware needs to be evaluated by human teachers.
- User friendliness level: highlights how the agent was accepted by students.

Several experiments concerning the second part of the evaluation study were conducted among 25 first year Master-students. Each session consisted of three students and one tutor (human or agent). The students experienced the traditional lab with the human tutor and also with the agent feature. After these experiments, students had to answer to questionnaires files. A sample of questions is the following:

- Do you consider the application attractive? If yes, what did you like about it?
- Do you think that the "agent" features prevented you from understanding the educational process better?
- Do you prefer the agent tutor instead of the human tutor? Please justify your answer.

Although the number of participants in the evaluation test was rather small for a quantitative evaluation, the trends seem to be unambiguous. Based on these questionnaires several statistics could be made. Some results concerning the agent integration and acceptance are shown bellow.



Conclusions

Within this paper it was shown how agent technology's presence in a synchronous virtual environment can overcome several major inconveniences of distance education systems like: awareness and communication.

Bogdan-Florin Marin, Axel Hunger
University of Duisburg-Essen, Germany
bmarin@uni-duisburg.de
hunger@uni-duisburg.de

The Civic Nexus Project: Supporting Sustainable Technology Practices in Geographic Communities

Civic Nexus (http://cscl.ist.psu.edu/public/projects/nexus/) is a three-year participatory design project with the goal of working with geographically-based community groups to understand how they learn about technology and develop the capacity to implement technology projects. In the Civic Nexus project, we study technology use and work practices occurring in nonprofit organizations as they work to achieve social and communitarian goals. Nonprofit community organizations are important to study because they employ a significant number of workers and they address social issues that impact the well being of most communities. In the United States alone, almost six percent of all organizations are in the nonprofit sector encompassing over 1.6 million organizations and 9.3 percent of all paid employees (Salamon, Sokolowki, & List, 2003).

The Civic Nexus project builds on previous work that takes a long-term participatory design approach that combines ethnographic fieldwork with participatory design to create information systems that address local needs (Carroll, Chin, Rosson, & Neale, 2000). We are now adapting this participatory design model to the study of nonprofit community organizations. For the last 18 months, we have conducted fieldwork and have identified (and in some cases carried out) technology projects with community partners located in Centre County, Pennsylvania (USA). We have worked with a diverse set of community partners that represent a range of concerns, including: water quality issues, alternate learning opportunities for high school students, local history, web hosting and support for area nonprofits, home ownership for low-income residents, emergency food services, community leadership, and emergency response issues.

Our research focus in the Civic Nexus project is on sustainability: finding ways of working with groups to help them develop the capacity to solve technical problems and to implement technology projects that meet their needs (Merkel, et al., 2004, 2005). Technology can play an important role in helping community organizations to achieve their mission. Websites and newsletters can be used to advertise services, recruit volunteers, and shape public discourse around a cause. Databases can play important roles in record keeping and in assessing a group's effectiveness. Calendars can be used to organize work and to promote an organization's activities. While there are significant opportunities, many community organizations face challenges when implementing IT in their organization because they often lack the financial and human resources and experience with technology needed to complete a project.

Because of our concern with sustainability, one of our research directions has been to consider the role that designers can play in facilitating community control over technology. Our research and design efforts involve finding ways for our community partners to take control of the design process itself by directing what should be done and by maintaining the technology infrastructure and the outcome that is produced. In our work, we have considered a number of different roles that emphasize the less directive role that we wish to play including that of a lurker, facilitator, consultant, and bard (Carroll, 2004).

Tied to taking more of a facilitative role in the design process, we have worked to identify technical and conceptual tools that promote long-term learning and technology planning. We have found that conceptual tools such as scenarios can be used by community groups to help facilitate the design process (Lee, et al., 2005; Farooq, et al., 2005). For example, in an environmental group that we worked with, we introduced the use of scenarios as a way to think about how an audience might use their website and to elicit design requirements. We also found that designers can play an important envisionment role, helping community groups see new ways that technology might be used in their organization.

Another central theme in our work is studying how groups manage technology learning in their organization. This goes beyond working with community groups to help them learn a set of discrete set of technical skills (e.g. skills required to update a website). It also includes helping groups make choices about how to implement technology in ways that connects to their work practices, history, and organizational roles. For example, we worked with a group of high school students to develop an online health course for their school (Xiao, et al., 2005). This required the teacher who directed the project to take more of a consulting role because she did not have the technical knowledge that her students possessed to complete the project. The project also served as a proof of concept that the technology could be used causing the teachers to reflect on (and in some cases resist) the use of online material in the classroom. We have found that there is no one size fits all strategy for working with community groups and that part of our role as designers involves provoking reflection on what counts as a "good" use of technology for a group (Lee, et al., 2005; Merkel et al., 2005). This has also led us to reflect further on the ways that designers can support the informal learning practices taking place in community organizations (Rosson & Carroll, 2005).

Finally, we have considered some of the unique structural features of nonprofit groups that impact design requirements for community-oriented information systems. For example, community groups often rely on volunteers to perform tasks central to their mission. This raises issues for community-oriented systems design such as group access control (e.g., specifying which volunteers can update or modify parts of a website) and knowledge management (e.g., as volunteers leave how can the group preserve and develop their understanding and use of technology).

As we move forward with the project, we will look for reusable strategies such as patterns that can be used to address sustainability in community computing settings (Carroll & Farooq, 2005). This includes the strategies that community groups have developed to manage technology in their organization. It also includes strategies that can be used by designers to encourage community groups to participate more fully (and even direct) the design and implementation process.

Extensions

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Cecelia Merkel (cmerkel@ist.psu.edu)
Lu Xiao (lxiao@ist.psu.edu)
Umer Farooq (ufarooq@ist.psu.edu)
Craig Ganoe (cganoe@ist.psu.edu)
Mary Beth Rosson (mrosson@ist.psu.edu)
Jack Carroll (jcarroll@ist.psu.edu)

Computer Supported Collaboration and Learning Laboratory
Center for Human Computer Interaction
School of Information Sciences and Technology
The Pennsylvania State University
University Park, PA USA 16802

TutorBot: an Intelligent System to support Tutoring on line in an e-learning platform

ABSTRACT

In the present work, an intelligent system called *TutorBot*, used as a support for tutoring activities on-line in a web-learning environment and based on the AIML language will be described.

TutorBot allows to automatize the interaction processes between *tutor-learners* guaranteeing forms of flexible learning in terms of space-time, thus minimizing the use of human resources, often lacking for the management of activities that involve a large target of users in a web-learning environment.

Introduction

From the analysis of e-learning systems, particularly dwelling upon the activities of tutoring on-line, some strategies and methodologies for the planning and implementation of *intelligent systems* have been individualized, in order to optimize the learning processes on the web.

The studying models have been analyzed inside the GRIAD (GRIAD is our Group of research (Department Economics and Statistics, University of Calabria)) and are founded on two essential *technical-scientific* areas: the Artificial Intelligence (*AI*) and the Web-based Informative Systems (*WIS*), from the integration of which up-to date systems can come out for the *information retrieving*, which can be implemented in an e-learning platform for the optimisation of the contents management [1].

The study in this direction has led us to the realisation of a software system called *TutorBot*, which founds its principles on the AIML (*Artificial Intelligence Markup Language*) technology applied and experienced in an e-learning environment [2].

TutorBot presents itself as an *intelligent agent* able to interpret the requests made by the learners in natural language and to give the answers through a *friendly* interface, with the advantage of emulating in an efficient way the human figure, which in the specific case is represented by the one of the Tutor during the activities of *tutoring on line*.

Later on, a description of *TutorBot* will be given first to understand better its running, the structure of its knowledge base, and finally the main expected benefits will be shown.

TutorBot: an AIML based application

The studies on the applicability of the AIML language in e-learning contexts and the need of optimizing the processes for the recognition of natural language, in order to support the *tutoring* activities in a *web-based* learning environment, has led us to the realisation of *TutorBot*. The system knowledge base founds its main characteristics on a series of AIML *data objects*, that are associated to appropriate meta-tag according to particular rules that substantially derive from the XML language. The informative base is structured in particular AIML files, which following the aiml standard can be easily produced from external sources as well and imported inside the database of the *LMS* to enrich the *TutorBot* knowledge base [5],[6].
We want to emphasize this last aspect, since according to this scheme, it encourages the fulfilment of high levels of interoperability and sharing of resources, so auspicate in the e-learning field and object of international research.

The main AIML *data objects* used for the management of the TutorBot Knowledge Base (KB) are listed as follows:

- *<topic>*: is the meta-tag that defines the content topic object of treatment; this is very important above all in a context characterized by a high complexity of knowledge, in which the same concept can refer to different topics;
- *<pattern>*: in this object, the information that will be useful for the *matching* with the requests in the dialogue phase between *TutorBot-learners* are structured;
- *<template>*: this object contains the relative answers to the patterns;

- *<category>*: includes in it the elements *pattern* and *template*.

An example of AIML code that shows how the same request can have different answers according to the reference topic, is represented as follows:

```
<aiml>
<topic name="history">
<category>
<pattern> What do you think about Rome?
</pattern>
<template>Roman empire was very powerful.
</template>
</category>
</topic>
<topic name="geography">
<category>
<pattern> What do you think about Rome?
</pattern>
<template> Rome is the most important city in Italy
</template>
</category>
</topic>
</aiml>
```

The mechanism at the basis of the AIML engine is a *stimulus-answer* type: to each user's Query, an appropriate answer that finds the best correspondence between the possible ones is given and takes the reference topic into account, after the intervention of an appropriate algorithm which takes care of the Input redefinition, that takes into account the rules concerning the symbolic reduction of the text, insertion and scission of sentences, the synonyms management, the grammatical corrections etc. For an exhaustive explanation, please consult [2].

Interaction between TutorBot and learners

TutorBot as thus projected can be integrated inside an LMS as a further means of communication/interaction to guarantee a form of tutoring on-line usable at any moment and anywhere [3],[4]. The learner has a friendly web interface at disposal, inside of which he can directly build his questions (Query) in natural language, as if he was asking them to a human tutor. The Query in object is intercepted by the artificial tutor and is simplified through an appropriate algorithm in its grammatical form, also individualizing in this phase the reference topic. At this point, a matching operation happens inside the database, and in the case in which TutorBot manages to find the answer, he directly gives it to the learner through the same interface, leading to the dialogue in real time.

When he will obtain the relative answer to the proposed query, the learner will be able to continue the dialogue with TutorBot, thus establishing a continuous interaction man-machine that emulates as far as possible the one between man-man. The running scheme is represented in figure 1.

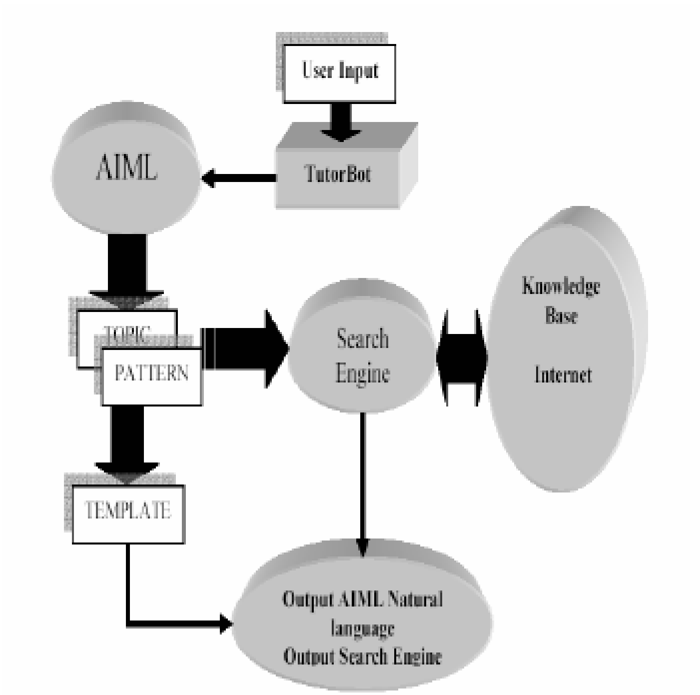

Figure 1: Interaction TutorBot-learner

The mechanism we have just described has been subsequently extended to give a solution even in the circumstances in which *TutorBot* would not be able to find an answer to the formulated Query, since absent in its database. In this case, a software module has been integrated for the support of *TutorBot*, that allows to send the "unsatisfied" Query automatically to a research engine in order to fill up the verified informative lack. The realised research Output will be proposed as *template* to the learner, using the same interaction interface [3]. A part of the AIML code that allows this operation is illustrated as follows:

```
<category>
<pattern>_ ROME *</pattern>
<template> The capital of Italy is Rome. You
can find other information about ROME in this
resource:
<search query="http://160.97.33.198/cgibin/search/search.pl?">
<topicstar/>
<star/>
</search>
</template>
</category>
```

Conclusion

The described system represents in conclusion an innovative tool for the processes management in an e-learning environment that, integrated in an *LMS*, is able to optimize either the *back-office* activities or the *front-office* ones. Thanks to this tool, a constant activity of tutoring on-line is guaranteed, in which the learner can interact at any moment and from anywhere with the artificial tutor in order to use the contents and have deepenings on these latter. Another important aspect is represented by the possibility of making the system able to manage possible verified "informative lack", having recourse to the integration of the research engine that is integrated in an automatic way and in background with TutorBot. Finally, the system being implemented in AIML language, thanks to this standard, it is easily possible to share the resources between heterogeneous platforms as well [5].

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De Pietro Orlando
Department of Economics and Statistics,
University of Calabria,
Rende, Italy
depietro@economia.unical.it

De Rose Maurizio
Department of Economics and Statistics,
University of Calabria,
Rende, Italy
mderose@economia.unical.it

Frontera Giovanni
Department of Economics and Statistics,
University of Calabria,
Rende, Italy
gfrontera@economia.unical.it

Awareness : Framework for e-learning

ABSTRACT

E-learning technology provides the tools necessary for collaborators (e.g., instructor and students) to achieve work (i.e., tasks and assignments) interactively. *"Awareness"* is one of the important features that should be carefully designed in an e-learning environment. While working virtually, collaborators will need to know necessary information (no more, no less) about the content of the event, the process, and the people who are involved. This article explores further the issue of awareness, and highlights the necessary awareness elements in a proposed theoretical framework.

What is "*awareness*"?

*"**aware-aware·ness** (noun) 1: archaic: watchful, wary, 2: having or showing realization, perception, or knowledge." Excerpt from WWWebster's Dictionary. Awareness support in CSCW systems' design is crucial, since "Knowledge of group and individual activity, and co-ordination are central to successful co-operation. These factors are clearly critical concerns in the design of computer systems [...]."* (Dourish and Bellotti, 1992).

In general, when people use technology to communicate, various types of information are communicated through many channels, both implicitly and explicitly. Types of awareness information vary from awareness of documents, projects, and tasks i.e., workspace, to awareness of the location and activities of co-workers i.e. social. Tele-pointers, office snapshots, video glances, document/project tracking, and background noise are some of the various forms of providing awareness which have been used up to date in latest e-learning technologies. In creating support for awareness, considerations include: what information to provide, how to provide it, how to give users control of the information, reciprocity, privacy, and interruptions.

Awareness and interaction can be both direct and indirect. Direct awareness and interaction are represented by for example, eye-contact, facial expressions, and gestures, while indirect awareness and interaction are represented by for instance, gaze, peripheral awareness, and synchronisation. The following are the types of awareness support found in the literature with brief explanations and examples of systems.

Research in e-learning applications e.g., conducting e-seminar, e-lecture, and e-workshop has resulted in highlighting what needs to be in awareness from the stakeholders' points of view. Typical stakeholders (roles) in an e-learning session are the presenter, the facilitator, the system administrator, and the participant. What needs to be *"in awareness"* is clarified in the following section, which raises the proposed framework (Figure 1).

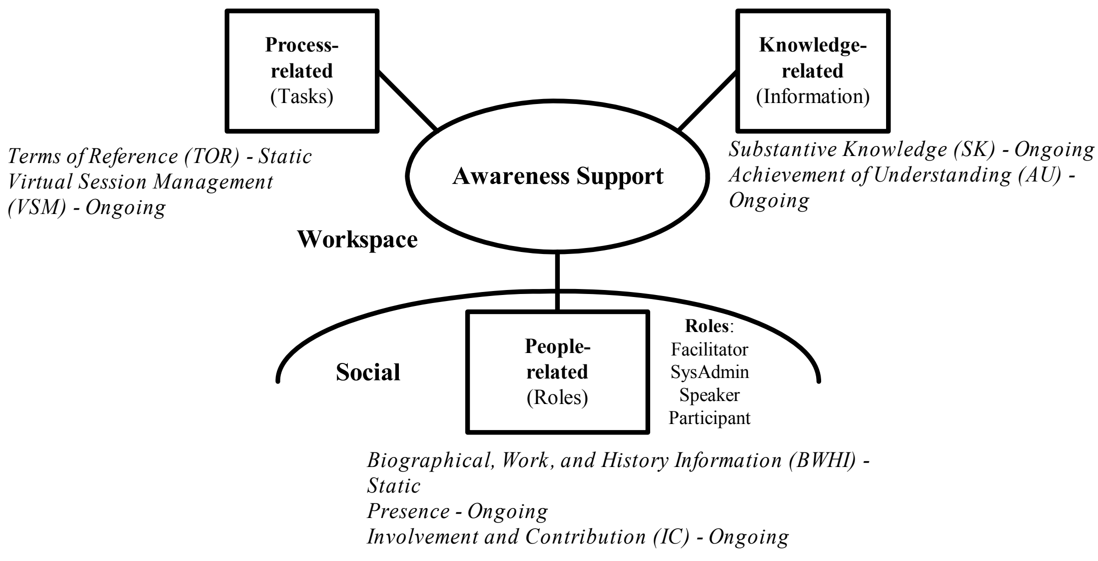

Figure 1 Triadic framework for *"Awareness"* support (Al-Matrouk, 2003)

Components of the framework are the awareness issues:

(1) Terms of Reference (TOR)

The following distinct items of information need to be shared and collectively understood:

- The tasks/assignments specification i.e., objectives and scope.
- Roles played in the event.
- Subject, topic, or problem clarification.

TOR is the agenda for the event, which includes information concerning the topic, brief information of what it is about, its scope, a list of its objectives and goals, the presenter and brief background, people who are going to manage it, and the structure of how it is going to operate. The structure lists and clarifies the stages of the event, time schedules and corresponding activities.

(2) Virtual Session Management (VSM)

This is mainly related to providing information about how the process is managed. Awareness of the roles, their responsibilities, and tasks (i.e., what they are supposed to do.), and the certain pre-requisites for managing the virtual event become crucial. "*Virtual Session Management*" denotes all the tasks that are involved in assuring the event runs properly and effectively.

(3) Substantive Knowledge (SK)

SK is concerned with the *content* of the virtual event (i.e., the e-learning session), specifically with information relating to the topic of the event, e.g., from the presentation itself, related questions and answers (QA), and discussion.

(4) Achievement of Understanding (AU)

Understanding in the process of conducting a virtual event is a cognitive human issue that is concerned with how well knowledge is delivered, perceived, and comprehended between the stakeholders (e.g., instructors and students) during the process. AU is associated with how well the process is structured, conducted, and maintained according to a well-conceived and designed agenda, which is also closely related to virtual session management (VSM).

(5) Biographical Work and History Information (BWHI)

The provision of presenters' and participants' biographical information is extremely useful in creating a social and friendly working environment. It is even more useful to support this with information about their work information (job titles, affiliations, work positions, etc.), and work experiences to establish the background work knowledge.

(6) Presence

Presence is an awareness issue, which indicates to the participants of a particular virtual session who is present, engaged in the process, and available for contact.

(7) Involvement and Contribution

IC generally refers to participants' interactions and activities with facilitators, the speaker, and each other in relation to the process at all phases i.e., prior to, during, and after the presentation. Participants' IC is specifically represented in answers to questions like '*Who said?*' and '*In response to who and what?*' with respect to the talk, QA, and discussion. Participants' IC also includes the *acknowledgement* of one's own questions and contributions during sessions.

Conclusion

"Awareness is still about the observability of relevant information and the media used to render observable entities and activities" (Berard and Coutaz, 1997). Working contexts and users' requirements vary, and so do awareness requirements. Understanding awareness needs in a working context requires a closer investigation and research, and there is not a generic guidance to follow in the design of awareness in an electronic system. The work setting defines what needs to be 'in awareness'. The framework highlights the high-level awareness requirements which are specific to the '*delivering an online electronic presentation*' context.

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Dr. Hasan Saleh Al-Matrouk
Kuwait Institute for Scientific Research
hmatrouk@kisr.edu.kw

Using a Knowledge Management System for E-Learning

ABSTRACT

This paper relates our experience with using a knowledge-sharing approach as adopted in a post-graduate diploma course to part-time students employed in an ICT-intense work environment. The need was for an extremely flexible internet-based knowledge management system to allow the quick and efficient inter-organizational distribution and management of course information including group work, assignments, readings and multi-media documents. This was achieved by using a state-of-the-art proprietary knowledge management system ("Archi") instead of the more traditional, less flexible e-learning systems such as WebCT. It was found that this approach is particularly useful for managing complex, dynamic and information-intensive part-time courses.

Description of the Distributed Knowledge Management System Archi

Archi is a proprietary web-based knowledge management tool that integrates an object-oriented knowledge repository, a customizable meta-model and a variety of user interfaces. It is based on a multi-user, three-tier model of browser client, web server and database server. It can manage a wide variety of knowledge asset types such as word processing documents, web-documents, presentations, models, plans, and multi-media files (http://www.inspired.org).

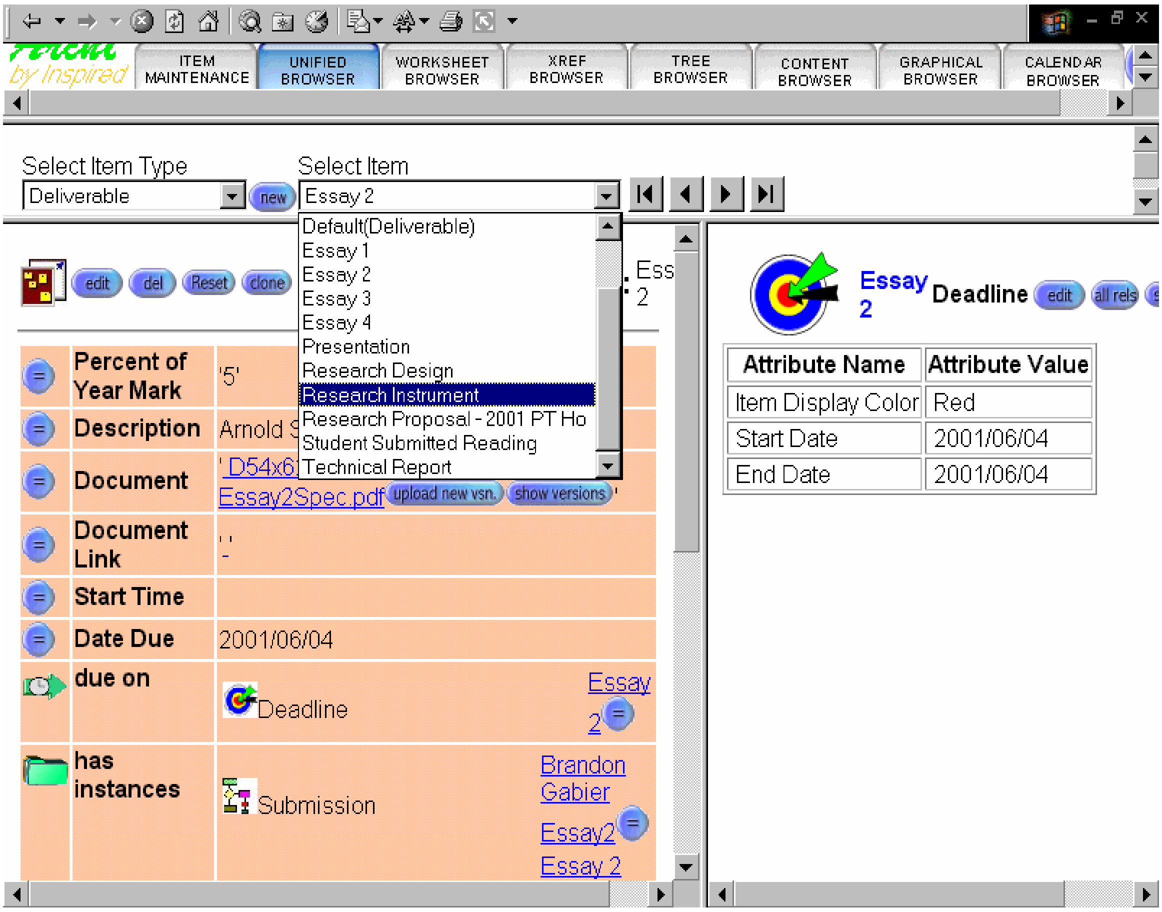

Figure 1: Screenshot of Archi's GUI

Its primary goal is to provide a platform for distributed knowledge management within information-intensive, professional group work environments such as business analysts, IS project managers and other professionals. Archi is driven by a customizable meta-model of the information which can distinguish various conceptual types of information held, along with rich attribute sets. The information base is navigated and queried using a standard web browser by means of a number of user views, such as the unified, item, cross reference, calendar, worksheet, tree and spatial views.

Using Archi for a part-time post-graduate course

Archi has been used to support two part-time post-graduate Information Systems courses since 2001: the post-graduate diploma and honours course. These are geared primarily towards IT professionals wishing to obtain a quality post-graduate qualification. The courses are characterized by small student numbers (20 to 40 pa). Most hold a demanding IT job and spend relatively little time at the University of Cape Town (UCT) outside the weekly contact sessions. All students have access to excellent computer facilities and the Internet at work, if not at home. They are generally highly IT literate. The courses have a high student-participation input, consisting of a large number of student group presentations in addition to the lecturer-driven presentations and work shops. Several individual student deliverables are also required.

In 2001, the course convenor Graham McLeod decided to use the courses as a beta-site for Archi. The paradigm of a distributed knowledge-base was considered to be an ideal match with the course attributes. The conceptual course meta-model was set up in a matter of hours and has required only slight refinements over the years. A typical snippet of the model is whereby the course object (e.g. "PG Diploma 2004") has various attributes such as a title, duration, description, etc. It is linked to a number of other objects in the database, including persons (examiner, coordinator, students), documents (books, FAQs, articles etc.) who can all have different relationships or roles. For example, a document can constitute a course prescription, required reading for a lecture session or other course-related activity (e.g. group meeting or examination session), a specification for an essay etc. (see figure 1).

Student Experiences with Archi

Two different cohorts of students were surveyed, one group in 2001 and another 2004. Students use the system a lot, both from work and from home. The most common uses were the downloading and uploading of course materials, including class presentations and readings (95%-100%). The calendar feature was also used by many (73%) but only a minority followed the hyperlinks to non-essential references available inside Archi (41%) or the world-wide web (only 27%).

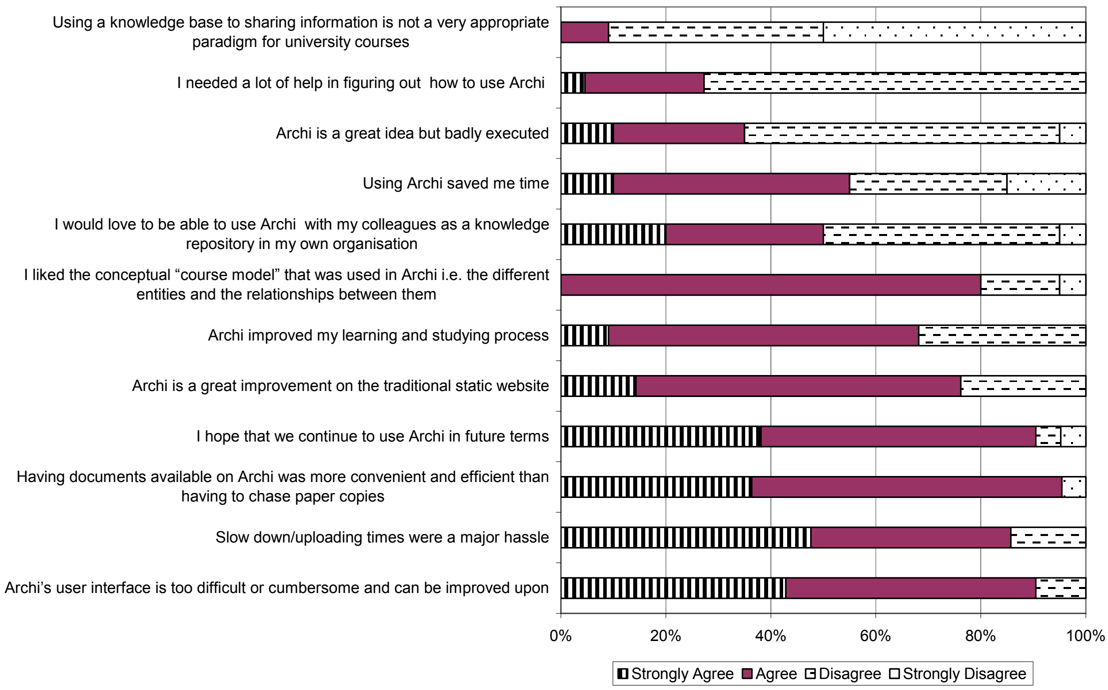

Figure 2: Student Feedback on Archi

As shown in figure 2, the most common problems experienced were bandwidth (which is not related to Archi but an infrastructural problem) and the complexity user interface. The latter has been modified and upgraded significantly during the last few years, with the addition of a student dashboard and a number of customized views, but the problem still persists. Strangely, although the user interface is fairly complex – possibly partly due to the conceptual course model – the actual learning curve appears to be quite short. On the other hand, students like the functionality of Archi, and most would prefer continued use.

Staff Experiences with Archi

Archi is a very stable tool. Software bugs are rare and its robustness is a pleasant contrast to some other web-based tools. Once set up, Archi requires very little maintenance. It currently runs on a "junked" webserver and, true to its claims runs with different clients (user tier), different web servers (middle tier) and relational databases (back-end tier).

Perhaps the biggest challenge lies in its flexibility. Unlike WebCT, which has basically a fill-in-the-blanks configuration, Archi requires the convenor to set up (or buy into a pre-installed) conceptual course model. Academics not used to working with multi-tier course administration tools, lament the latencies and user interface constraints which are inherent with a web-based platform.

An important practical constraint is the fact that Archi has a relatively small installed user base, which makes system support an important issue. Due to the university regulations, this also means that it has to be managed and maintained by the department itself rather than forming part of the university-wide technical IT support structure. Finally, it is also difficult to see Archi being adopted in its current incarnation in course environments where the students are less IT proficient, or do not have access to the same rich IT infrastructure at home or in their work environment.

Summary

The IS Department at UCT uses a number of different web-based paradigms to enhance the quality and efficiency of the student learning experience. These range from standard course web pages to WebCT. However, it was found that the use of a distributed web-based knowledge management system could fill a useful niche for very knowledge intensive courses with lots of cooperative learning.

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Jean-Paul Van Belle
University of Cape Town
Private Bag, Rondebosch, 7700, South Africa
Tel: +27-21-6504256
Fax: +27-21-6502280
jvbelle@commerce.uct.ac.za

Composing Learning Objects

Introduction

Learning object is any entity, digital or non-digital, that may be used for learning, education or training [1]. Learning object metadata describes any kinds of learning objects, such as study courses, the pedagogical features of the course, the contents, special target groups, and the technical requirements of the study course.

Learning object metadata is used for many purposes:

- It facilitates the learners' decision-making process and aids the educational institutions to provide suitable information about their course supply.
- It is also needed for improving the retrieval of learning objects, for supporting the management of collections of learning objects.
- It is also used for guiding non-experienced users through a large collection of learning resources

In addition to these features we are extending the ONES-system [2, 3, 4] in away that we can use learning object metadata for automatic composition of learning objects.

Learning Object Content Model

The composed learning object (in our learning object content model) is a *course* composed of *lessons.* Further each lesson is comprised of a *video*, *slides* and *textual presentation* (Figure 1).

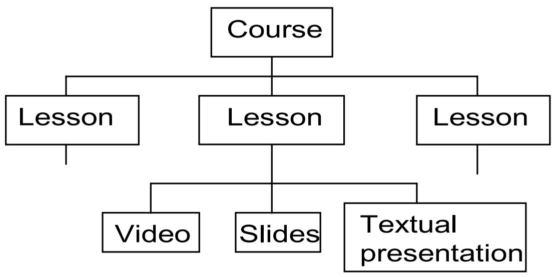

Figure 1. The structure of a course

We have attached metadata to each lesson (for now lessons are seminar presentations given by the students).

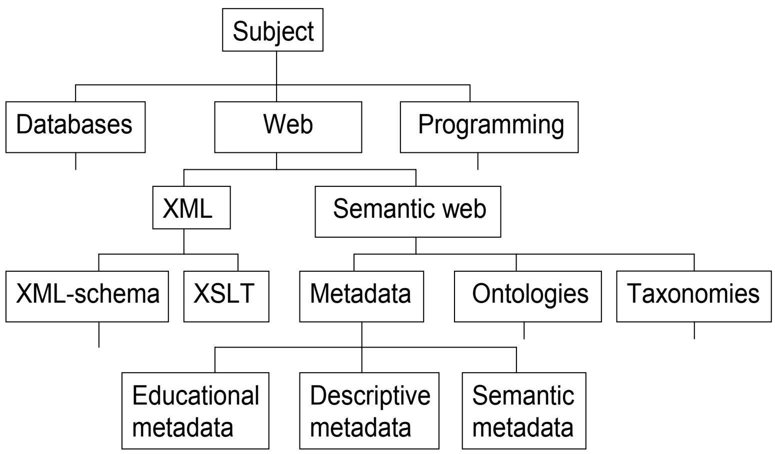

Figure 2. A taxonomy for lessons.

The composition of a course is based on the metadata item *subject.* To standardize the values of this metadata item we use taxonomies. In Figure 2 is an example of taxonomy.

Each *subject item* is specified by picking appropriate nodes of the used taxonomy and giving weights on the picked nodes such that the sum of the weights equals to one. The weigh of the nodes that are not picked are zero. So mathematically, *subject item* is a vector in the vector space which dimensions are the nodes of the taxonomy.

A nice feature of this approach is that by varying the weights we can express the subject of the lesson as well as the level of the lesson. To illustrate this, let us consider the lesson "The future of educational metadata". So it is obvious that the weights should be given at least on the nodes "Educational metadata" and "Metadata". Further, if the lecture is strongly focused on educational metadata then it should have rather high weight (e.g., 0.8). So the more specific the lesson is the higher the weights of the lower level nodes have in its *subject* item.

Specifying Composed Learning Objects

The composed learning object is comprised of a set of lessons. Each lesson is specified by a *profile*. The *profile* has same structure as the *subject item* of a lesson, i.e., a set of picked nodes of the taxonomy such that the sum of their weights equal to one.

For example, assume that we want to specify a course "*Metadata and ontologies in the semantic web".* Its first lesson should be an introduction to the topic, and so its profile should have high weights on the nodes near the root of the taxonomy, e.g., weight 0.3 for the node Web and weight 0.7 for the node Semantic web. If we want that the next lesson focus only on metadata, we should set weight 1 to the node Metadata. If we want that the third lesson deals different classes on metadata we could give for example weight 0.4 for the node Educational metadata and weights 0.3 for the node Descriptive metadata and Semantic metadata.

Computing Composed Learning Objects

Composed learning object are produced by an Object composer (Figure 3.).

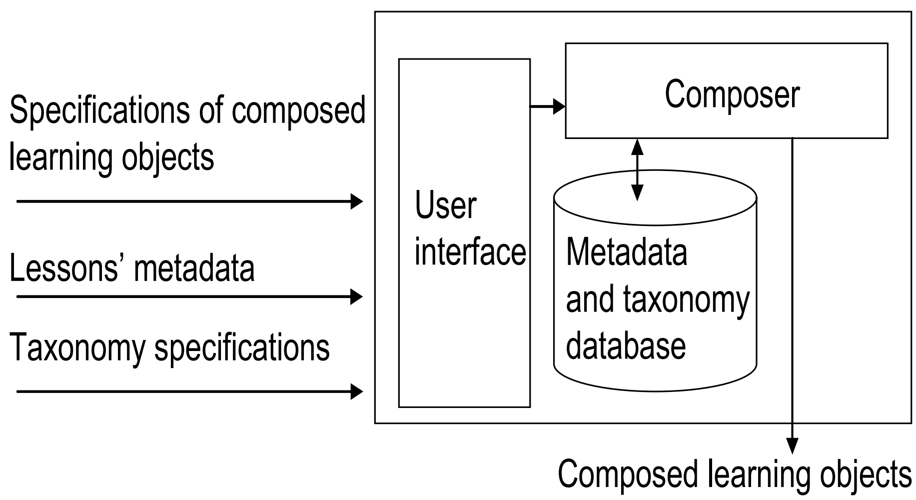

Figure 3. The modules of Object composer.

The object composer has three modules: User interface, Composer and the Metadata and taxonomy database. The database includes lessons metadata (including subject items)and taxonomies. When the Composer receives a request (a set of lesson profiles), it performs a distance query for each lesson profile and returns the lesson having the best match.

The used matching algorithm [5] calculates the cosine measure between the query (a vector) and the lessons profiles (vectors). As a matter of fact the algorithm does not compute distance measures but rather approximates distance measures by computing the angles of the query vector and the vectors representing learning objects.

Conclusions

Automatic composition of learning object requires that we must have a model of learning objects. For now, as the only form of learning objects that we have are lessons also our content model is rather simple. However, in proportion as we store other kind of learning objects on the database we will extend our content model.

Automatic composition of learning objects also requires that we must have some way to describe the subject of learning objects as well as the subject of composed learning object. We argue that by using the vector model instead of only using keywords we can achieve much higher accuracy with respect to the content of composed learning objects.

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Juha Puustjärvi
Lappeenranta University of Technology
Laboratory of Communication Engineering
P.O. Box 20, FIN-53851 Finland
Juha.Puustjarvi@lut.fi

Mobile Learning with Intelligent Download Suggestions

ABSTRACT

In this paper, we propose a scheme to provide intelligent download suggestions for mobile learning contents using artificial intelligence. To deliver learning content via mobile devices, including PDA's, cell phones, pocket PCs, or other handheld devices, the file size must be considered. The success of downloading a large file depends on the Internet traffic at the moment.

According to the induced decision tree, we can predict whether the downloading would be successful. If not, the server would suggest the user not to download the large file at the moment or to download an alternative file.

1. Introduction

The Internet-based environment has been rapidly replacing the traditional lecture-based one due to due to the rapid growth of information and communication technologies. More and more people try to apply the artificial intelligence techniques, such as the agent technology [1][2], to the application of distance learning. In 2004, Büchner and Patterson suggested platforms to keep track of learners' activities including content viewed, time spent and quiz results [3]. In [4], the authors presented a PDA-based interface for a computer supported system. Some researchers use mobile videophone and e-learning to help a student with severe physical impairments [5]. In [6] and [7], the authors developed a museum tour guide system on PDAs. Many studies have been developing software tools that can in used in various mobile devices to personalize the learning context. In this paper, we propose a scheme to provide intelligent download suggestions for mobile learning contents using artificial intelligence.

The remainder of the paper is organized as follows. In Section 2, different mobile learning devices are introduced. In Section 3, we present the scheme to provide intelligent download suggestions for mobile learners using artificial intelligence. The mobile learning platform is described in Section 4. Finally, the conclusions are made in Section 5.

2. Mobile Learning

Mobile learning has been defined as learning that takes place via wireless devices as mobile phones, personal digital assistants (PDAs), or laptop computers.

To deliver learning content via mobile devices, including PDA's, cell phones, pocket PCs, or other handheld devices, the file size must be considered. Large files, such as video clips, are not recommended. Some alternatives like audio files might be considered.

Table 1 illustrates users might download mobile learning contents at anytime, anywhere. The success of downloading a large file depends on the Internet traffic at the moment. In this study, we propose a scheme to provide intelligent download suggestions for mobile learning contents using artificial intelligence.

Table 1. An example of users' profile when downloading a large file during a time slot

	Attributes						
User	Location	Time Slot	Holiday	Thruput	Largest File Size	Wireless Network	Successful
No.1	163.26.228.12	9:00~ 10:00	No	500Kbps	800K~1M	802.11g	Yes
No.2	203.67.153.76	19:00~20:00	Yes	250Kbps	800K~1M	802.11b	No
No.3	60.248.40.208	15:00~16:00	Yes	400Kbps	500K~800K	802.11b	Yes
No.4	210.243.17.97	14:00~15:00	Yes	450Kbps	> 1M	802.11b	No

No.5	N/A	11:00~12:00	No	30Kbps	< 50K	GPRS	Yes
No.6	222.156.11.196	20:00~21:00	No	200Kbps	50K~500K	802.11b	Yes
No.7	220.22.71.103	10:00~11:00	Yes	300Kbps	500K~800K	802.11b	No
No.8	N/A	12:00~13:00	No	20Kbps	50K~500K	GPRS	No
No.9	61.63.100.137	23:00~00:00	Yes	600Kbps	> 1M	802.11g	Yes
No.10 . . .	203.71.160.118 . . .	9:00~10:00 . . .	No . . .	400Kbps . . .	500K~800K . . .	802.11b . . .	Yes . . .

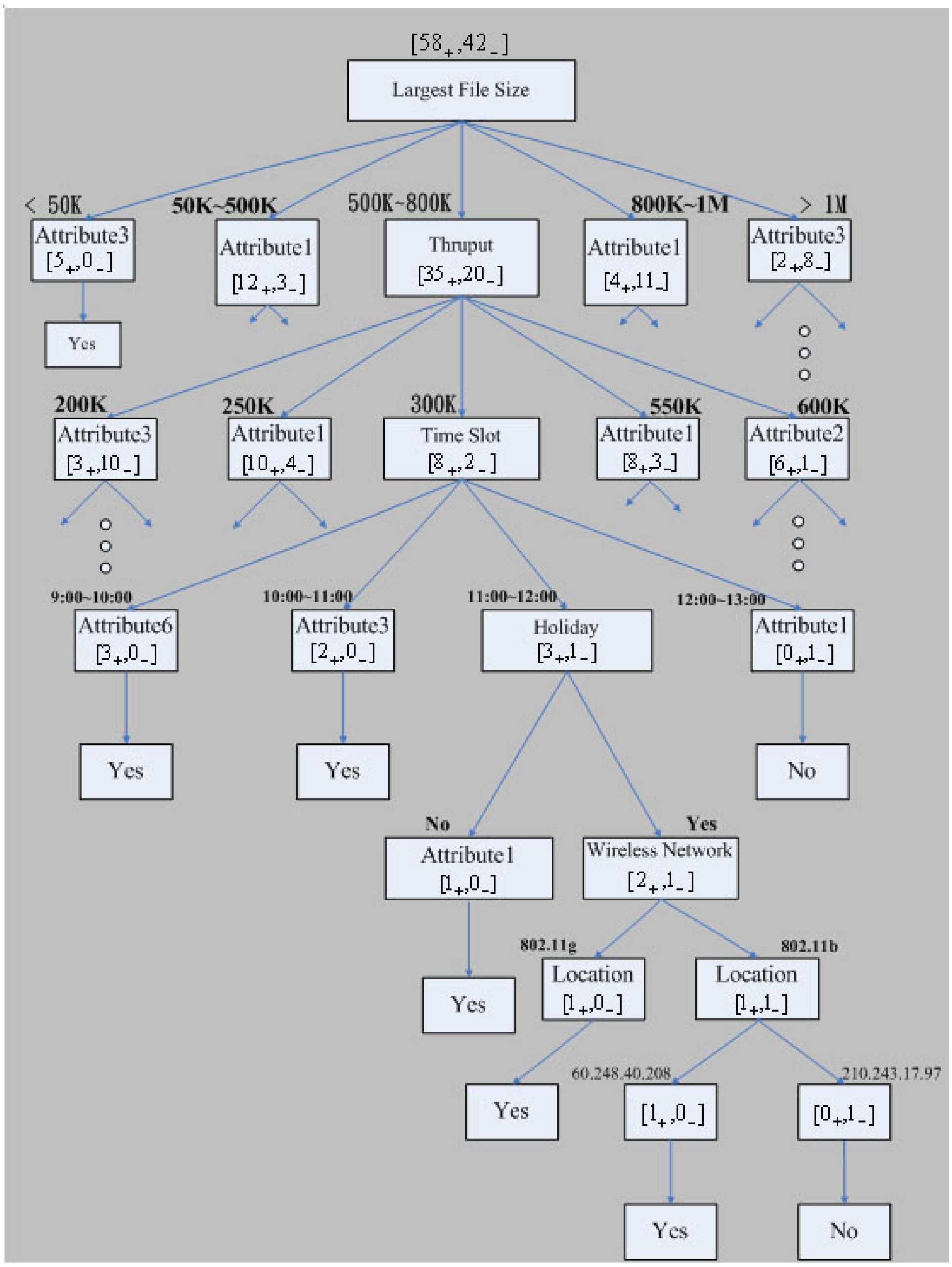

Figure 1. The decision tree to predict whether a large file would be downloaded successfully

3. Artificial Intelligence

In Figure 1, we see a tree used to determine whether the downloading is successful or not. This kind of tree is called a **decision tree** [6][7]. A decision tree takes in the attribute values and outputs a Boolean decision. Once a decision tree is constructed, we start at the root node to check the attribute value. Based on the attribute value, the branch labeled with the corresponding value is chosen. Continue checking the next attribute value until a leaf node is reached. According to the induced decision tree, we can predict whether the downloading would be successful. If not, the server would suggest the user not to download the large file at the moment or to download an alternative file.

3.1. Entropy and Information Gain

Entropy measures the impurity of a data set S and is defined as:

$$\text{Entropy (S)} = -P_+ \log_2 P_+ - P_- \log_2 P_- \quad (1)$$

where P_+ is the proportion of positive examples while P_- is the proportion of negative ones. The entropy reaches its maximum value of 1 when half of examples are positive and half are negative.

3.2. Decision Tree

Decision tree induction involves a set of training data to generate a decision tree that can classify the training data correctly. If the training data represent the entire space of possible data adequately, the decision tree will then correctly classify new input data as well. The best-known decision tree induction algorithm is ID3, which was proposed by Quinlan in 1980s. The algorithm builds a decision tree from top down and finds the shortest possible decision tree to classify the training data correctly. The method used by the algorithm to determine which attribute to be chosen for each node is to select the attribute that provides the greatest **information gain** at each stage [6][7]. A perfect attribute divides the examples into sets that are all positive or all negative. The information gain of an attribute tells us how close to perfect the attribute is. Information gain is defined as the reduction in entropy and calculated by:

$$Gain(S,A) = Entropy(S) - \sum_{V \in values(A)} \frac{|S_V|}{|S|} Entropy(S_V) \quad (2)$$

where Entropy(S) denotes the entropy of a data set S and can be calculated by equation 1. $Gain(S,A)$ is the expected reduction in entropy due to sorting S on attribute A.

4. Mobile Learning Platform

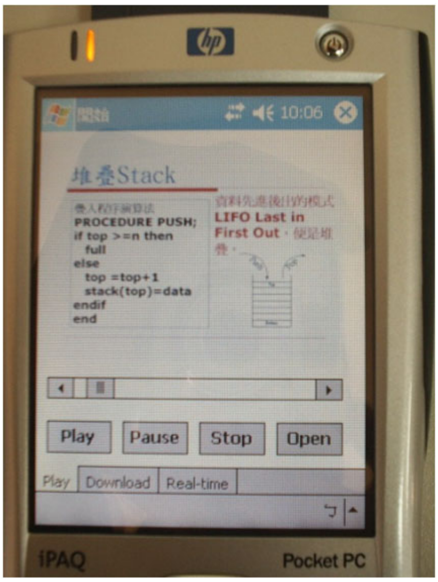

Figure 2. The user interface of playing mobile learning contents

The user interface of playing and downloading mobile learning contents are shown in Figure 2 and Figure 3, respectively. According to the above induced decision tree, we can predict whether the downloading would be successful. If not, the server would suggest the user not to download the large file at the moment or to download an alternative file.

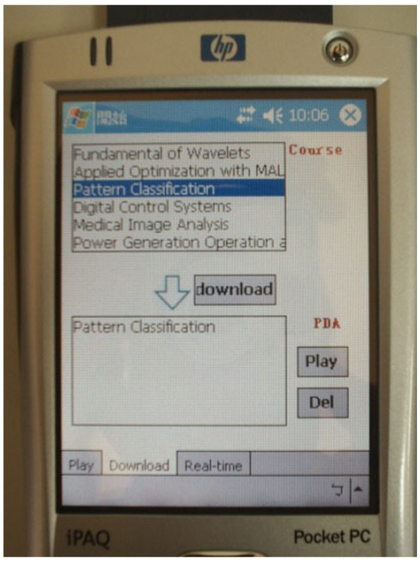

Figure 3. The user interface of downloading mobile learning contents

5. Conclusions

In this paper, we propose a scheme to provide intelligent download suggestions for mobile learning contents using artificial intelligence. The decision tree tells the importance of each attribute. After the decision tree is constructed, we can see that not all attributes are needed for the prediction; in other words, the download suggestions might be made by only 2 or 3 attributes. Unfortunately, it is quite possible that even when vital information is missing, the decision tree learning algorithm will find a decision tree that is consistent with all the examples. This is because the algorithm uses the irrelevant attributes. In the future, some technique to eliminate the dangers of over-fitting must be developed in order to select a tree with good prediction performance.

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Shu-Chen Cheng
Department of Computer Science and Information Engineering,
Southern Taiwan University of Technology, Taiwan
kittyc@mail.stut.edu.tw

Chih-Wei Su
Department of Computer Science and Information Engineering,
Southern Taiwan University of Technology, Taiwan
awaysu@yahoo.com.tw

Yen-Ting Lin
Department of Computer Science and Information Engineering,
Southern Taiwan University of Technology, Taiwan
ricky014789@yahoo.com.tw

3D Modelling of Human Organs

ABSTRACT

3D modelling of human organs is a project that combines multimedia technology and 3D animation development. The aim of this project is to develop an interactive learning material for early stage medical students and individuals who are interested to get knowledge about parts of the human body. The 3D images for the selected human organs are created for this project so that the user can view the models and use all multimedia applications such as viewing the movie of 3D models, narration for explaining the functions of the modelled organs, and also to do a quick indexed search of scientific terms for medical uses all by navigating a user friendly interface. In short, the main features of this project are to provide information about human organs in a 3D environment.

Introduction

3D modeling of human organs and skeleton is not a new technique in Information Technology since their function is to reinvent medical purposes especially in education. In the area of learning the medical clinical anatomy, there are some exceptional programs that can run and combine an established multimedia computer-based education. The programs that help students to learn about anatomy, pathology and radiology but programs about learning an interactive multimedia of 3D human organs and skeletons are very insufficient in the market now with several weakness where their interfaces are still somewhat confusing for the user and the information are presented using text to deliver the details about the the models.

3D Human Organs is a project that combines multimedia technology and 3D animation development. The 3D images for the selected human's organ are created for the user to view the models with use of multimedia applications such as viewing the movie of the 3D models, narratory explaination of the functions ,and quick search indexing of scientific medical terms all by navigating through a user friendly interface. The target is to reduce costs in medical learning industries and increase efficiency of the usage of 3D technology especially while doing basic medical learning process.

Materials and Methods

This project is implemented using a software called 3D Studio Max for designing the 3D model of human organs; Adobe Photoshop for editing and createing suitable graphics designs for the page's linking button and the interface. The Sound Forge software is used for recording and editing the sounds. The Video shows are exported from the source to this combination. Then all the multimedia elements are combined together using macromedia software called Flash MX. Most of the objects are created using polygons then applying extrude to the polygons and shaping them according to the actual objects. For objects that are relatively complicated, surface combination and modifier are used. Figure 1 shows the main interface of the software.

Basically, the main features of this project are to provide information about human organs with 3D view of the organ in concern. The User can view the rotation of the 3D models while listening to the explanation from the narrator.

To select a new 3D model image the user has to move the mouse over the image. An eye icon will appear along with the name of the item next to the cursor or pointer. Selecting one of the buttons will display a new page of the human's organ 3D model. Selecting the text icon will provide information on the image the user is viewing. Figure 2 shows a 3D model of the human skull, Figure 3 shows a 3D modeling of a human backbone, and Figure 4 shows one complete backbone 3D model with textual information alongside the image.

Figure 1 shows the main interface of the software.

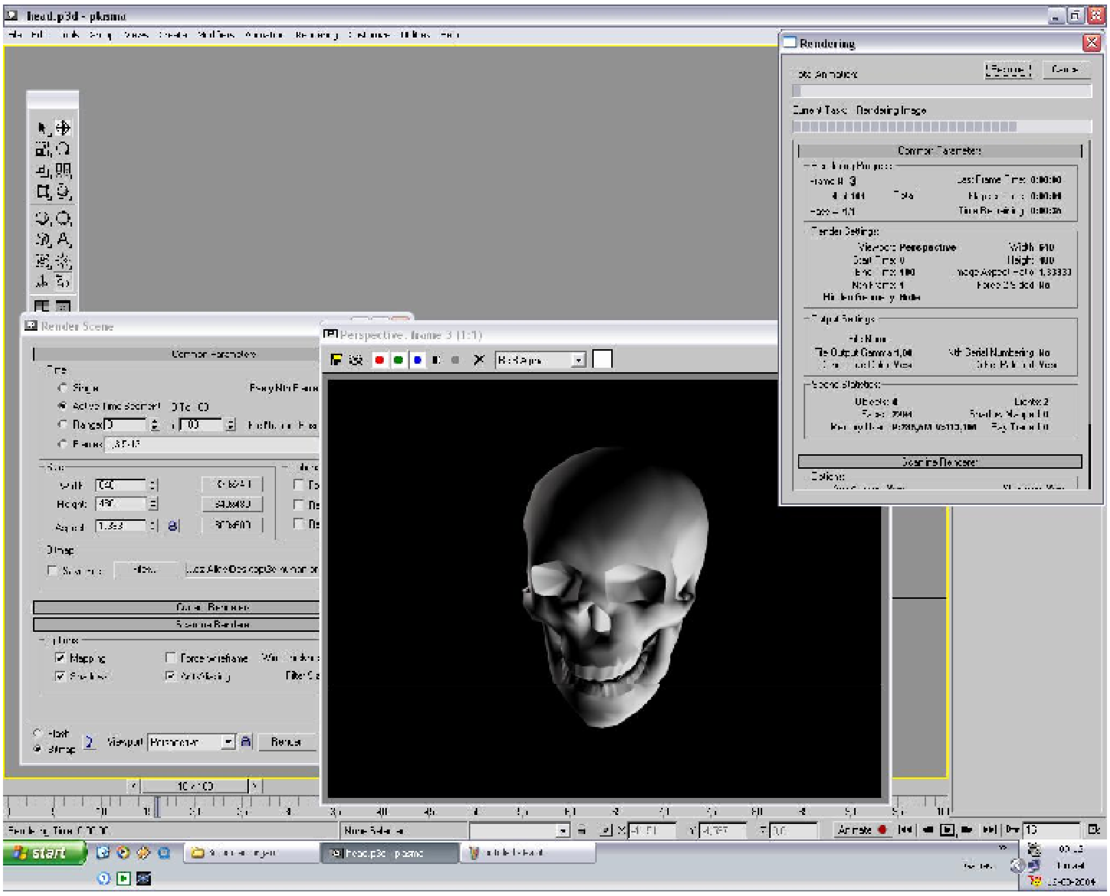

Figure 2 shows modeling of the human skull

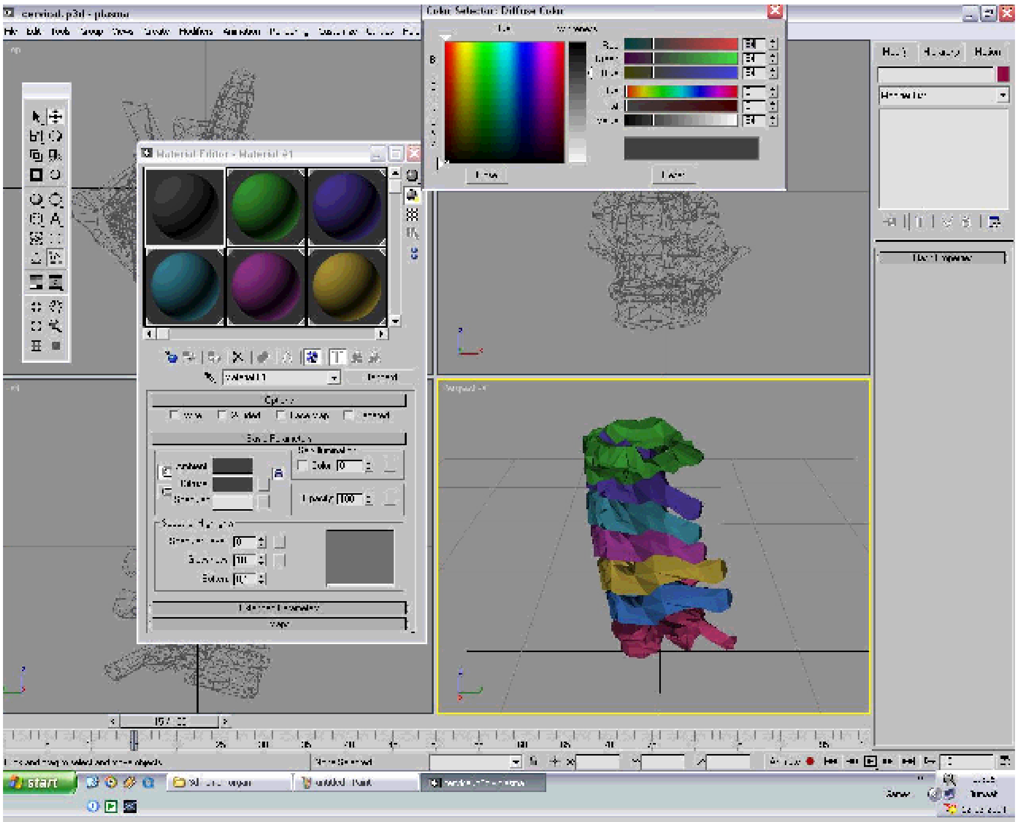

Figure 3 shows the modeling of the backbone

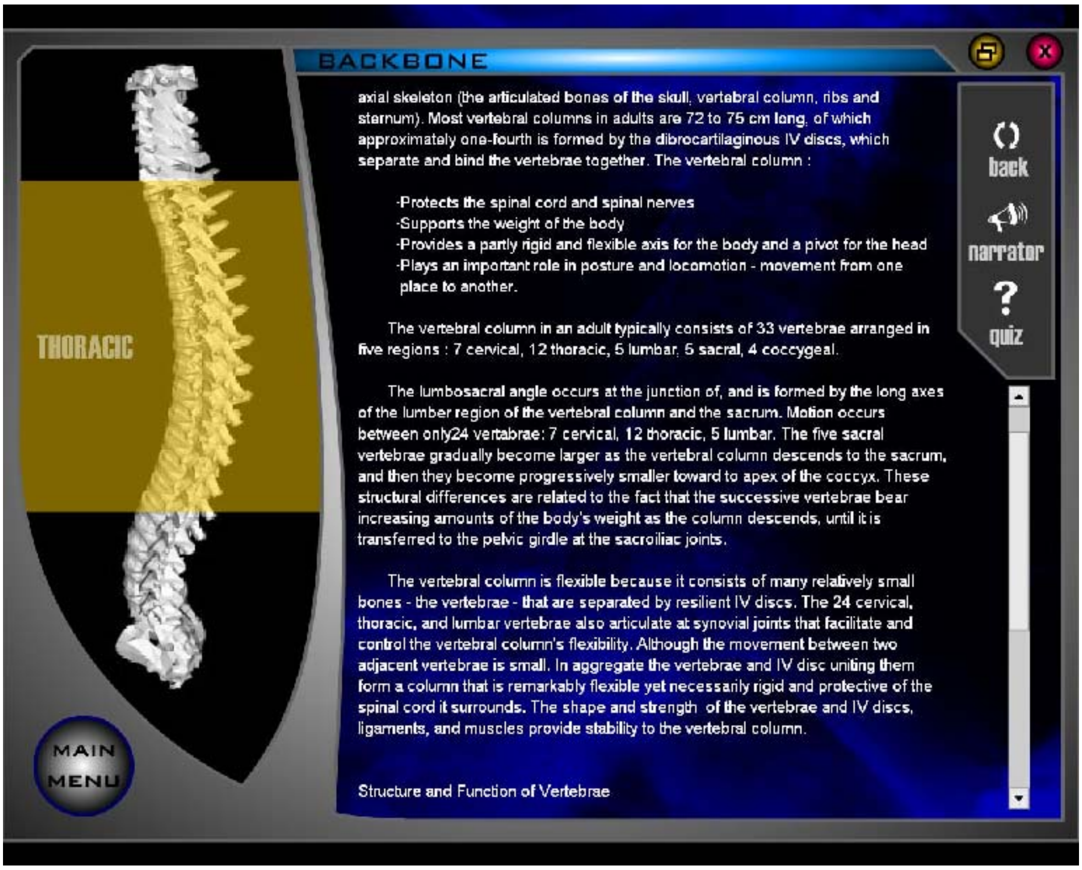

Figure 4 shows the complete backbone model

Results and discussion

Creating an interactive learning will attract fullest attention from thousands of people to put their effort to learn using maximum hours per day. User-friendly, 3D models, colorful interface can get user attention if the information is put on an interactive CD. Therefore the information about the organs and skeleton selected ; 3D model, data, images, audio, plus a special features such as quizzes and quick search are organized in a nice interactive CD. The CD includes special features such as try and error quizzes which the user can click on the button for quizzes, then a short questions page appears about the organs or skeleton that the user chooses. The second features is quick search whom the user can utilize o find the meaning and description of difficult or unfamiliar scientific terms referring to the alphabet indexing. The interactive CD also includes a movie of injury for the models. The user can view the short movie of the 3D animation while the organ model is making a rotation and the user can click to see the model from a 3 dimensional view; top, front and perspective view.

Conclusions

3D Modelling of Human Organs is a project that focuses on applying 3D modeling and animation technology for the learning of medical student.

The project's target is to develop various new techniques in creating a product that will enhance and simplify the clinical anatomy oriented learning. In this high- technology world hopefully this project will increase the efficiency in using paperless learning while reducing the costs and expenditures in the educational system and also attracting more people for gaining medical knowledge. Also, 3D Modeling of Human Organs is created specifically for medical students. In addition, this is an opportunity to develop further understanding and explore the 3D modeling and animation world deeply. In short, this project uses 3D modeling and animation technology as a new step in Clinical Anatomy basic learning that will attract more students and public to simplify their medical learning process.

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Majdi Al-qdah and Norkhairanizan bt Che Mohd. Khan
Faculty of Information Technology
Multimedia University
Jalan Multimedia, 63100 Cyberjaya Selangor,
Malaysia
majdi.qdah@mmu.edu.my

Technology Accountability

Administrators at all levels of the educational hierarchy are attempting to survive a sociological phenomenon, the increased utilization of technology (Harder, 1997). Technology for both instructional and administrative uses has created a schizophrenic atmosphere for educational leaders (White, Ringstaff & Kelley, 2002). Improvements in administrative and instructional efficiency will not be significant unless a comprehensive and systematic plan for evaluating the technology and its application to the educational organization is both present and used.

Accountability

Accountability has always been a concern for educational leaders (Kirst, 1990); however, only recently has technology become a focus for accountability. The globalization of the 21st century fuels the current accountability because the future of America is tied inextricably to education and education is functionally coupled with technology.

The long-range purpose of technology accountability is to enhance productivity. A second powerful application of accountability is comparing productivity across organizational components. Also, technology accountability is necessary to measure quantitatively the investment in educational technology. There are three models used to measure accountability: the Efficiency/Effectiveness Model; the Cost-benefit Model; and the Utility Model.

Efficiency/Effectiveness Model

Efficiency and effectiveness coexist in complex educational organizations (Waite, Boone & McGhee, 2001). Educational organizations can temporarily survive without perfect efficiency, but they usually die if they are ineffective. The mutual goals of increased efficiency and improved effectiveness are vital to hardware and/or software purchases. All purchases and technology applications must reflect both increased efficiency and improved effectiveness.

Efficiency typically implies short-term accountability, while effectiveness connotes long-term accountability. According to Kohn (2000), “it is easier to measure efficiency than effectiveness, easier to rate how well we’re doing something than to ask whether what we’re doing makes sense” (pp. 3-4). Drucker (1974) stated: “Efficiency is concerned with doing the right things. Effectiveness is doing things right” (p. 45).

Cost-benefit Model

Educational leaders are forced to objectively measure and quantify persons, programs and processes. The discrepancy of quantity over quality creates an unhealthy ethos that threatens to destroy the very persons and programs that technology accountability measures are designed to quantify (Berliner & Biddle, 1995).

The threat of measuring and improving aspects of operation not essentially vital to overall organization productivity is called the threat of "suboptimization"--optimizing the performance of secondary, or even irrelevant, aspects of operation. The sub-optimization threat is especially valid in today's large and complex educational institutions where there are literally hundreds of unique units (Guile, 2001). The currently accepted model of technology accountability becomes one of political posturing, not one of sound educational practice. This means that technology purchases should take place when supporting data can predict the benefit of the cost incurred.

Utility Model

The concept of utility implies that administrators must examine the overall percentage of the institution that utilizes the technology. America’s educational institutions have been subjected to externally driven demands for accountability that have not proven to be effective (Ginsberg & Berry, 1998). Often these demands have pressured administrators to make technology purchases that have little or no application in the real world. Irrespective of technology utility, numerous states have advocated strong external accountability without considering the low organizational capacity of educational entities to deliver critical productivity (Newman, King & Ridgon, 1997).

Applications

Accountability measures offer administrators data to substantiate changes to enhance productivity. The key concept is determining how to measure productivity in service organizations like schools and colleges (Houston, 1999). According to Goodlad (1979), "My major objection to accountability based only on outcome measures of behaviorally defined competencies and proficiencies is that it takes one's attention away from all those qualitative elements inherent in the educational process" (p. 313).

The United States government has tried repeatedly to influence education at the state and local levels (Johnson, 2001) for the expressed purpose of holding them accountable for performance and productivity (Raywid, 2002). As a result, administrative applications of technology are often forced while instructional applications of technology are optional.

Change is difficult and often produces results that are not intended, therefore, organizational capacity to meet technology accountability demands must be critically examined (Olsen, 2000). Educational leaders need to understand technology accountability, know their organizational capacity and be able to clearly articulate the role technology accountability plays in their organization. The size of the accountability movement indicates that the survival of public education may very well hinge on the ability of educators to demonstrate productivity and accountability in a chaotic marketplace (Fusarelli, 2001) .Technology accountability is here to stay, but it must be understood in relation to the contextual reality of schools and colleges.

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James F. Burnham
Georgia Southern University

Michael D. Richardson
Georgia Southern University

Howard C. Woodard
Georgia Department of Education

richmd@frontiernet.net

A collaborative approach for development of Arabic courses for e-learning, A case study of Tunisian-Saudi Arabian experience

ABSTRACT

In this paper, we present a case study of collaborative experience to develop an Arabic course for e-learning. This course is developed at distance jointly in Tunisia and in Saudi Arabia Kingdom. This development consists mainly in translating an available course written in French. The initial course is designed with respect to the paradigm of learning objects. We show in this paper that this way of designing courses not only leads to their reusability but also facilitates significantly translating them to other languages.

Introduction

The learning objects paradigm [3] is deeply rooted in the evolution towards a knowledge society, which entails the need for lifelong learning and for more flexible, adaptive learning systems, inside and outside the public education system [2]. With the spread of new technologies of Information and Communication, we are living a huge demand for Web-based resources for work and learning and thus for the reusability and interoperability of digitized information materials.

The use of learning objects is a relatively new emerged approach and technique for modeling and implementing learning contents. It enables reusability and sharability of learning material between several institutions around the world that offer courses on the Web.

This case study starts from a common need to Arabic courses for initiation to basics of computer science in particular courses such as words, excel, …etc. Such courses will be used for professional training in Tunisia and for academic education in Saudi Arabia. Remark here that in Tunisia most academic education are done in French, however in Saudi Arabia education is in Arabic.

The initial French MS-word course is developed in the research Unit of Technologies and Communication of the University of Tunis [1] by a professor with the help of two specialists in multimedia to treat images, audio, and video sequences, also, to prepare flash animation and Java applets. This course is provided on-line by the Virtual University of Tunis [4] for many institutions in Tunisia.

Description of the experience

The methodology used to translate the course consists in treating every learning object separately, i.e. if the learning object is a text we have just to translate the content. If it is a video sequence, the task consists on recording a new sequence in Arabic corresponding to the initial French sequence, … etc.

All new developed materials are exchanged between the above authors by e-mail in order to validate them and eventually to correct and/or modify them.

Evaluation of the cost of development

As first results, the first chapter has been ready in a very short period. This result shows that the cost of development of a new course is extremely low comparatively with the initial French course. For instance, there is no new investment in the design of the structure for the course (story boards) nor in the graphical charts and templates.

The new investment in the content development is mainly devoted to translate texts. However the new investments in the technical implementation consist mainly of the new recording audio and video sequences after just translating their associated texts. Modifying flash animation by replacing French texts to Arabic format. Moreover, images are modified only if they contain texts.

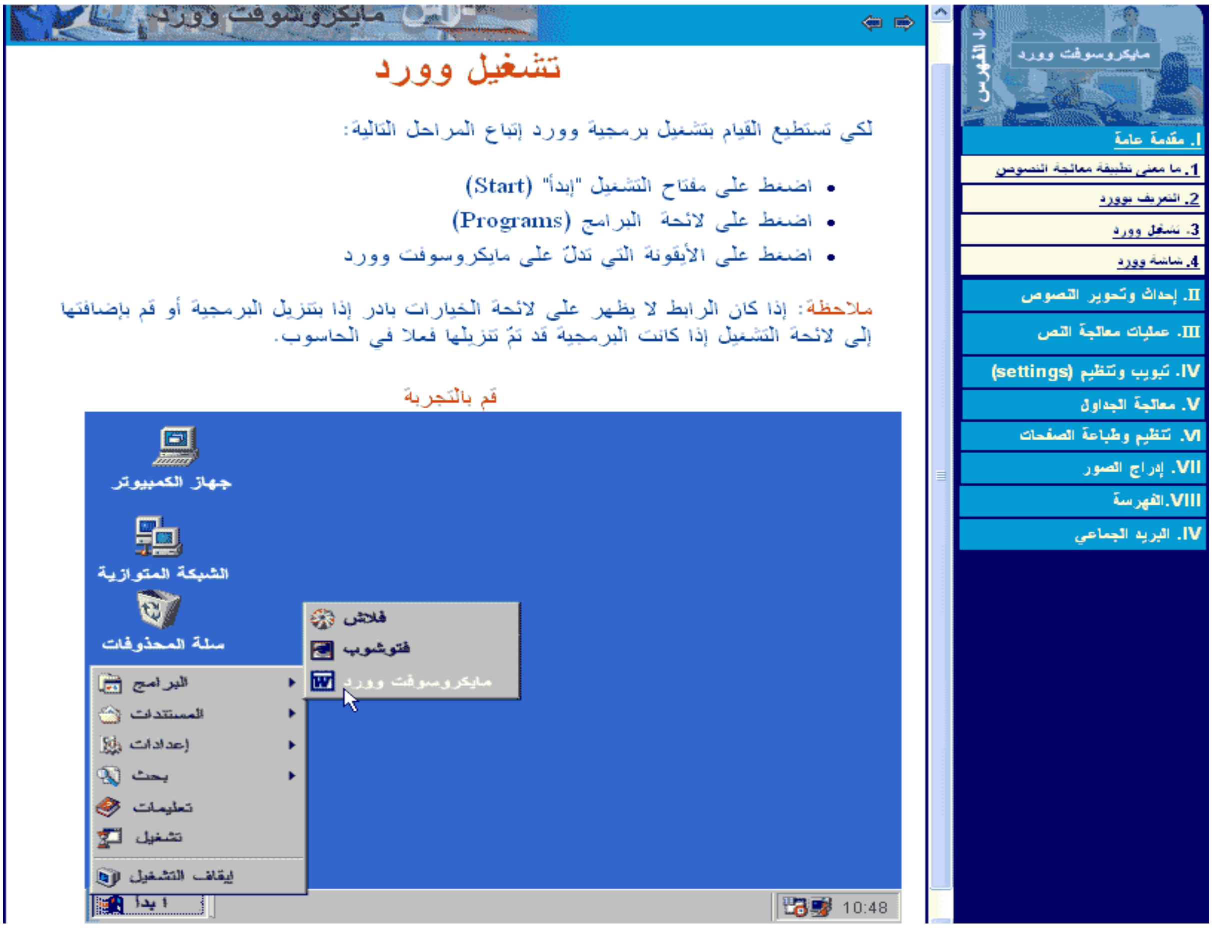
Regarding the flash animation, the programmer has to deal with the problem of compatibility between Arabic and French since the writing direction in Arabic is from right to left.

Concerning now the learning object metadata, we had in fact two aspects to consider : metadata content and metadata content manipulation. Two choices were possible : we rewrite metadata in Arabic to permit their interrogation in Arabic. This alternative is easy to implement but it needs that the author has to deal with metadata every time he added new content in Arabic. However the second alternative, that we adopted, consists in conserving initial metadata and adding information about existence of an Arabic version. With this solution, the author is completely discharged of metadata rewriting, however we need a tool that translates Arabic requests to French. This new investment is justified due to the importance of the amount of translated metadata content.

Conclusion

We have shown in this paper that it is possible and useful for Arabic educational institutions, professors, and learning content providers to contribute to the usage of learning objects.

First results of this collaboration seem to be promising in both pedagogy and research. In pedagogy, we plan to continue development of the whole of the course. In research we are already working in designing automatic tool to translate and/or analyse Arabic metadata based requests in learning object paradigm.



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Mohamed Jemni
Ecole Supérieure des Sciences et Techniques de Tunis
Research Unit of Technologies of Information and Communication (UTIC)
5, Av. Taha Hussein, B.P. 56, Bab Mnara 1008, Tunis, TUNISIA
Mohamed.Jemni@fst.rnu.tn

Abdullah Ali Bahattab
Computer Technology Department
College of Telecommunication and Electronics
Jeddah, Saudi Arabia
abahattab@yahoo.com

SMACKDOWN in the Telecommunications Course, an Application of the ARCS Instructional Design Model

Today's twitch-speed students, raised on Nintendo, MTV, cell phones and instant messaging, require new and innovative strategies for instructional design if the teacher is to capture and hold their interest (Tapscott 1997). In the October 2004 edition of the Learning Technology Newsletter, Tim Roberts (2004) applied John Keller's (1983) ACRS (attention, relevance, confidence, and satisfaction) model of instructional design to curriculum design for distance learning. This article extends Roberts' ideas into the realm of instructional design for an introductory course in data communications through the use of an unlikely metaphor; pay-per-view wrestling.

Keller's (1983) instructional model consists of four phases; arousing interest, creating relevance, developing an expectancy of success, and producing satisfaction through intrinsic/ extrinsic rewards, and has become known as the ARCS (attention, relevance, confidence and satisfaction) model. Roberts (2004) established the link between learning, interest, and motivation and showed how the ARCS model improved learning in distance learning courses. This paper describes an extension of this linkage to the presentation of content in a data communications course, specifically network physical and logical topologies, channel usage alternatives, and Ethernet addressing via an ARCS format designed to increase student interest, motivation and thereby learning.

To reach the students, the teacher needs to raise the interest level of the students. The first two components of the ARCS model, arousing of interest and establishing of relevance, support just this objective. Therefore, using the metaphor proposed by this paper, we introduce the concept of pay-per-view wrestling as a surrogate vehicle to demonstrate the actual course concepts. Additionally, the introduction of such an unexpected metaphor raises the level of humor in the class which has been shown to be an additional tool for raising student interest Tomkovick 2004).

Almost all university students in the United States have had experiences with cable television and almost all are aware of, and a significant sub-set has had personal experience with, pay-for-view programming. The use of pay-for-view world wide wrestling provides a high level of relevance because of the ubiquitous nature of cable TV in America and the regular advertising on the cable networks for their pay-for-view offerings. Using the world wide wrestling metaphor introduces humor to reduce the stress often associated with the introduction of complex technical topics. Humor has also been identified as a technique to raise student involvement and interest (Tomkovick 2004), (McLaughlin 2001).

The third stage of the ARCS model is "developing an expectation of success". Since the student's have personal experience with the pay-per-view cable technology and the discussion is somewhat light-hearted due to the objective of obtaining professional wrestling programming, the students accept that the underlying concepts are manageable and that they can master them. This conclusion has been confirmed through empirical observations and interactions with numerous classes and their performance on subsequent examinations that cover this subject area.

The final stage of the model, satisfaction, occurs as the explicit knowledge contained in both the textbook and lecture notes becomes internalized as tacit knowledge on how this pervasive technology functions.

The components of the class to present the desired learning concepts are introduced using the following scenario. First the general subject area is introduced through the use of an unexpected statement/question on the order of "Let's talk about watching pay-for-view world wide wrestling on TV." This opens the subject discussion by raising the first component of the ARCS model, attention. The class is queried about what are the requirements to watch a pay-per-view match on television. The discussion ultimately evolves to describe the solution as an addressable cable TV converter box. This answer leads to the question of how to identify one specific cable box from the other cable boxes in the neighborhood and how this relates to the physical topology of the network. The telephone system is used as an example of a star network to contrast with the bus topology of the cable TV system. The need for an addressing scheme that works at the instrument level in a bus network is explored. This discussion leads into the analogous function of the address in the cable TV converter and the MAC (media access control) address used by Ethernet for identification of sending/receiving nodes. Once the students grasp the concept of the addressable converter, there is little difficulty extending concepts used in the metaphor to the real subject, the Ethernet address.

The discussion then moves to how cable TV uses the coaxial and fiber optic cable to transmit the different programs. This becomes the basis for a discussion of broad-band vs. base-band use of the media and how the cable TV systems employs frequency division multiplexing to allow the simultaneous transmission of 100+ channels of programming.

Experience has shown that use of the ARCS model's structure applied to personally relevant activities leads to a highly interactive and dynamic learning environment. The addition of humor also helps to involve the students in the learning activities. The metaphor of purchasing pay-per-view programming via cable service is very appropriate for students in the USA due to the pervasive nature and market penetration of cable TV services in the United States. Other nations/cultures could require a different technology metaphor, such as the cell phone in Western Europe.

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Randall C. Reid
Richard G. Platt
MIS and Management Department
University of West Florida, Pensacola
Fl 32514, USA
rcreid@uwf.edu
rplatt@uwf.edu

Breaking communication bottleneck for student group through online learning system

Effective communication stands at the nexus of the whole process in knowledge sharing. There are barriers in communication that require a system that can tackle holistically the identifiable issues [1]. Communication does not only involve sharing common languages but also the artifacts being used as the media in the knowledge transfer, common communication time for both parties and common social identities. Social identities are referred to the race, culture, sex and personality of the communicator. When the common language is shared by the communicators, the meaning, interpretation and understanding of the language are almost uniformed. Communication requires sufficient time to be allotted to both communicators for them to listen, think, analyze and respond. Artifacts are sometimes used as communication media for visible and audible illustrations in the form of video, sound and documents presentations. For example, the road map is a communication media for an effective communication in giving direction. Social identities may affect communication such that one is more comfortable to converse with someone s/he already knew. We investigate three of these factors by conducting experiment of group discussion in two modes, namely the traditional face-to-face and the online discussion.

The three factors that are hypothesized in this experiment are that

i) online discussion which provides comments that are associated with artifacts as communication media will make understanding about the contents in the artifacts easier. Artifacts and communicated messages that are stored in accessible form are preferable for future reference;
ii) online discussion provides ample time for the discussants to think and rationalize what to be said and consequently enable him/her to provide more ideas and personal thought;
iii) online discussion provides less stress, less inferiority complex in posting ideas and less worry with others knowing her identity.

The online discussion is performed using Intelligent Conversational Channel (ICC) that was developed to facilitate the communication among the students [2,3]. The system allows the students to discuss, argue and suggest within the group through the internet environment. The students are assigned to nine groups and each group consists of 5 – 6 members. Each student is given a login ID based on the student ID and these information is not displayed through out the entire knowledge sharing session. The students display themselves using nicknames for the purpose of referring to each other during the online discussion. Therefore, a student can appear as more than a single person if two nicknames are chosen. The students can upload articles (pdf, Microsoft word or ps), pictures (bitmap, tiff, pcx), application files (excel, powerpoint), video files as artifacts attached together with messages explaining their opinions, arguments or summaries.

The experiment is conducted on Management Information System class where there are two modes of group discussion. The first mode uses traditional face-to-face group discussion and the second mode is an online using ICC system. The students are asked to investigate several topics and discuss them. The group discussion runs for 10 weeks for both modes. The traditional face-to-face group discussion is conducted during the class period and extendable outside of the class. The online discussion is an outside class activity and the system is accessible at anytime. At the end of the 10^{th} week, the students are required to fill in survey questionnaire.

The following table shows the question statements that investigate the three factors stated earlier. There are 40 students who participate in the survey. All of the students are involved in Project 1 and Project 2. Project 1 is the face-to-face group discussion while Project 2 is the online group discussion. In the question statement, the student can circle either P1 (Project 1) or P2 (Project 2) or both (if they feel the statement is true for both projects). For the question statement that requires False or True, the student is allowed only to choose one. The counts are the total number of circles marked by the students.

No	Factors	Question statements	Counts
1	Comments that are associated with artifacts as communication media will make understanding about the contents in the artifacts easier. Artifacts and communicated messages that are stored in accessible form are preferable for future reference	The gist from the articles can easily be understood from the comments given by the group members	P1 – 12 P2 – 29
		The artifacts should be kept in a repository for future reference by other group members who are interested in sharing similar knowledge	True – 36 False – 4
2	Online discussion provides ample time for the discussants to think and rationalize what to be said and consequently enable him/her to provide more ideas and personal thought	I have more time to think and rationalize of what being discussed by the group members	P1 – 14 P2 – 29
		I contribute more ideas and personal thought without hesitation	P1 – 19 P2 – 27
3	Online discussion provides less stress, less inferiority complex in posting ideas and less worry with others knowing her identity	I have less stress in group discussion	P1 – 17 P2 – 27
		I find that less feeling of inferiority complex	P1 – 20 P2 – 31
		I do not have to worry about people knowing myself when ideas are expressed	P1 – 12 P2 – 30

For Factor 1, there are two question statements that support the claim. There are 29 (P2) students feel that the articles are well-understood from the online discussion even though there 12 (P1) of them feel the opposite. One of the count claims that the question statement is true for both environment. The second question statement receives majority supports that knowledge repository is important in knowledge sharing.

For Factor 2, there are two question statements to confirm the claims. Both of the question statements receive more confirmation from the counts that online discussion (P2) provides more time for the communicator to think and rationalize as well as contributes more ideas and personal thought.

For Factor 3, the three question statements find that the online discussion (P2) provides less stress, less feeling of inferiority complex and less worry about people knowing the identity of a person who posted the message. Our result here may differ from [4] as the discussion period for this experiment is longer.

The students are a mixture of different races mainly Chinese, Indians, Malays and foreign students. Their social identities are not known among them such that they find the online discussion that does not display their actual identities make them more comfortable in posting their comments.

Note

The research was previously conducted in Faculty of Computer Science and Information Technology, University of Malaya.

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Syed Malek Fakar Duani Syed Mustapha, PhD
Dhofar University
smfdsm@yahoo.com

Towards Semantic-Aware Learning Object Retrieval – An Ontological Approach

Introduction

In recent years, several international organizations have devoted themselves into building e-learning standards, such as SCORM [1][2] and IEEE LOM [3], which are proposed for describing the structures and contents of integrated teaching materials. Following the standards or no, there are currently many Learning Objects available for corporate and academics. Despite the available of such growing libraries, e-learning now faces a more pressing challenge: how to find the most appropriate contents for a learner, advanced or not. Some of the standards, such as SCORM LOM, facilitate the locating of learning objects from a repository by extended sharing and searching capabilities. For example, a learner can search via keywords, data, author, or any other metadata fields. However, because SCORM LOM defines over 60 fields, an average learner will find it difficult to completely specify the conditions in such a large number of attributes.

There are other significant problems in learning object retrieval:

(1) It is quite different between traditional document retrievals and e-learning objects retrievals. The major problem is that it's almost impossible to analysis the contents of a learning object for specific search terms. This is because the contents of learning objects are various; it could be a text, a web page, a flash, an audio, a piece of video, or any kind of media.
(2) It is hard and unreasonable to ask a learner to be familiar with the LOM standard, in contrast to the pure text keywords in document retrievals.
(3) Providing a menu of fields for a user to fill in makes the system inflexible and a learner still has to familiar with various types of metadata. That is, although the titles and the descriptions of a field is well defined, the contents of learning objects still depend on the common usage of languages, glossaries, expert opinions, personal experiences, and so on.
(4) Most systems just provide the capability of keyword match, and are deficient in semantic search and query reasoning.

One way to overcome the problems mentioned above is by using well-defined learning object metadata ontology and by indexing learning objects according their meaning rather than some keywords. An ontology [4] defines a set of common understood terms, called the concepts, and relationships among these terms. In a well defined ontology, the concept hierarchy and the relationships can also be used to evaluate the semantic distance and the relevant degree.

The Proposed Ontological Approach

We propose an architecture for Semantic-Aware Learning Object Retrieval; it is shown as in figure 1.

The main purpose of using ontological representation is to gain the ability of inferring a user's intention, even though the user may not know what he/she wants exactly. In our model, the followings are the key works to reach the goal.

- ***Build a Semantic-Aware LOM ontology***. The ontology is capable of addressing the relationship and evaluating the semantic distance between learning objects, and of inferring a user's intension and disambiguating the query by evaluating the weight of matched instances.
- ***Expand Queries.*** Recommending high relevant objects can increase both the recall rate and the retrieval precision.
- ***Map learning object metadata instances into ontology (indexing documents).*** A LOM description will be distributed into the ontology as the instances of concepts. The mapping is automatically completed by the system, and the author of an LOM description need not understand the structure of the LOM ontology. Indexing the LOM description into the ontology is the key step for instantiating the relations between learning objects.

We have been using Protégé 2000 [5] to build the ontology and the output is set to be OWL's [6] format. Documents with OWL's format can easily be queried by XQuery or other higher level XML and ontology query language.

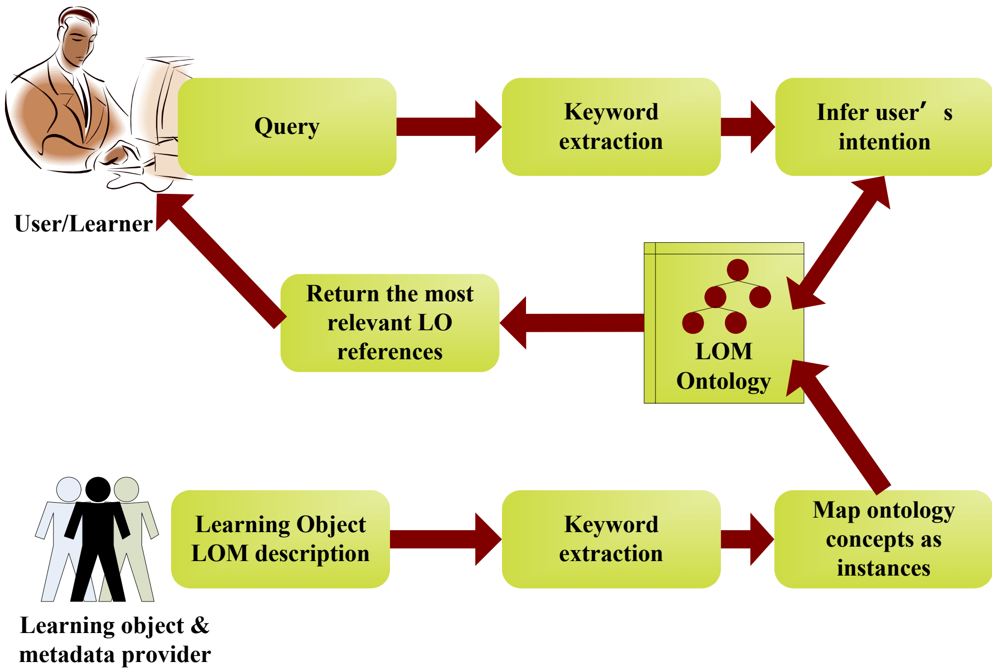

Figure 1. Semantic-aware ontological approach for learning object retrieval

Conclusions and Future Work

In this article we propose a semantic-aware, ontological approach for learning objects retrieval. By applying the ontology technology to the e-learning environment, e-learning systems can be more intelligent, powerful, and adaptive. This ongoing project will also integrate a well-defined learner's feedback mechanism to score learning objects and help the system to recommend high quality learning objects.

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Ming-Che Lee
Department of Engineering Science,
National Cheng Kung University, Tainan, Taiwan
limingche@hotmail.com

Tzone I. Wang
Department of Engineering Science,
National Cheng Kung University, Tainan, Taiwan
wti535@mail.ncku.edu.tw