ATILA: A Technology Innovative Learning Assistant

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ABSTRACT

With the increase in uptake of online facilitated learning environments, there has arisen a great need for effective learning management systems. Current e-learning platforms fail to provide support for deep interaction and collaboration, and fail to take full advantage of the powerful simulation capabilities of modern desktop computers.

We describe a design for an innovative learning management system that implements an Online Facilitated Learning (OFL) based approach to curriculum delivery. This proposed system's features include, among others, visual authoring tools, virtual classrooms, the ability to display content in each student's mother tongue and an intelligent course flow controller which acts as a virtual tutor.

This working paper provides a glimpse into the design of ATILA, an Open Source Learning Management System (LMS) that will fully satisfy an existent educational need in the rapidly growing field of Bioinformatics. The creation of this system will be able to greatly improve the quality of bioinformatics educational services, and will be extended to high schools, to improve the science and educational levels amongst students of a previously disadvantaged background.

Key words and phrases: Online facilitated learning, learning management system, educational support

INTRODUCTION

Since the emergence of the Internet in the 1990's, the education community has witnessed the appearance of online software products aimed at supporting teaching and learning activities globally (O'Leary, 2002). Higher education is currently evolving rapidly from the traditional classroom based and problem based learning approaches towards an increasing virtual learning environment (Armitage & Jenkins, 2002; Dale & Lane, 2004).

These virtual learning environments have the potential to exploit the best outcomes from traditional approaches. However, the current web-based tools fail to successfully simulate the perfect environment by omitting collaborative and interactive learning techniques (McCahill and Lombardi, 2004).

Online facilitated learning (OFL) is a method of teaching/learning in which students have the opportunity to actively seek the solution to a problem but with the help of a virtual or real-time facilitator (Martinez, nd). OFL methods aim to eradicate previous failures in simulating a traditional learning approach that combines the best outcomes of problem based learning and passive learning (Backroad Connections, 2002). These methods make use of advanced software communication features to create quality online interactions, and have been shown to enhance student outcomes as a result (Gold, 2004).

This paper proposes an innovative system that enhances OFL methods with the inclusion of an intelligent course workflow manager able to interact with students directly using natural language processing, as a virtual tutor, and that will attempt to deliver content, including the discussion, in the student's mother tongue, and pedagogically.

LITERATURE REVIEW

Virtual Learning Environments (VLE) are learning management software systems built to facilitate online methods for delivering course data or sharing knowledge bases (Chelin, 2003). These learning systems encourage new ways of learning, assist in providing equality of opportunity to learners and lead to more constructivist and better quality learning (Chelin, 2003; Gold, 2004).

Since its inception, virtual learning environments have not been as popular as originally planned. This is due mainly to a lack of understanding as to what constitutes a VLE (Roberts et al., 2005). Past VLEs tend to neglect the idea of an interactive learning environment, subjecting the learner to huge information dumps (Deepwell, 2002) without stimulating learners, failing to develop their skills (Deepwell, 2002; Giorgini & Cardinali, 2003). Furthermore, these past VLEs neglected to implement quality interactions and fail to enable students to acquire skills that may be transferred to other settings (Sabatini, 2001; Oblinger & Hawkins, 2006).

Few VLEs actually define the requirements for ensuring success in the virtual environment (McCahill & Lombardi, 2004), with most of these learning environments

becoming knowledge dumps (Bianchi et al., 2003; Prendergast, 2004). With this disregard for peer communication and tutorship, it becomes evident that most current VLEs are unsuccessful (Prendergast, 2004; Dale & Lane, 2004).

Recent changes with regard to VLEs have resulted in better enhancement of these online learning environments (Nijholt, 2002). Advancement in technology and redefinition of course content have shifted the presentation of course material using a more interactive and facilitated learning approach (Elliot et al., 2000). This Online Facilitated Learning (OFL) approach makes use of facilitators, creating more interaction and bridging the gap between passive and problem based learning more effectively.

An example of an OFL in practice is the Virtual Resource Room, pioneered by the University of Sydney and aimed at biology students (Peat, 2000). This online domain encourages communications with both peers and staff, and provides access to data on a 24-hour basis (Peat, 2000; Backroad Connections, 2003). Its success has been outlined by a well-balanced mix of lecture notes, journal articles, teachers and peer discussion groups, and is actively contributing towards a knowledge based society (Peat, 2000).

Another example of an OFL is the S-Star (www.s-star.org) course that is currently employed as an OFL for Bioinformatics students across the globe. This collaboration between trainers from Stanford University in the USA to the Karolinska Institute in Sweden and the University of Sydney in Australia makes use of an online learning environment where lecturers, debates and live discussions can take place. However, since most of the tutors are located in awkward time zones of approximately 6 hours either ahead or behind South Africa, it becomes very difficult for South African students to partake in the activities and make use of the tutors.

This loss of social interaction may have adverse effects on learners, as the exchange of ideas, thoughts and feelings among people is believed to lead to higher levels of learning (LaPointe, 2003). It thus becomes evident that in order for learners to benefit from facilitated online learning, that virtual tutors be introduced into VLEs (Ong & Hawryszkiewycz, 2003). These motivations form the basis of the ATILA project.

PROPOSED IMPLEMENTATION

This project will create an innovative Learning Management System (LMS). The system will implement an OFL based approach to curriculum delivery for which the teaching and learning needs of the NBN will be used as an initial test bed. The NBN presents a challenging working environment that recruits instructors both nationally and internationally and requires the ability to create and update course content in a standardized format, register students online and provide 24-hour access to the content. Once developed, broad applicability of this system to both secondary and tertiary education will be seen.

The proposed system will consists of several components or modules. The Core, which makes use of Softlech's (www.softlech.com) Developer Framework for PHP (DFP), is a reusable set of components which define a Framework for easy and robust software development. This framework provides services such as data access, basic administrative services, controls to generate forms, html tables and other user interface elements. It also provides a mechanism to join together the different layers of the application, viz. user interface, web layer and data layer. DFP has a dual license, an open source license for open source projects, and a commercial license if the library is used in commercial applications.

Another module consists of the Authoring tools. These will be used by educators and other content developers to create educational products. These will include web-based user interfaces to create a course, individual lessons, tests, and individual questions. A course can also be defined programmatically, using ATILA's scripting language. This way of defining a course would allow creation of a course offline, as well as easily sharing content among different sites running the system.

Figure 1 shows a screenshot of different proposed components of the online classroom.

The next component is the online classroom, which will be used to deliver content to learners registered for a course or a lesson. The first version of the classroom will require frames, and will contain the following screens: menu, board, communication

area, user's area. The menu area will be located at the top, and will provide a set of links or buttons to access some of the services available to students. The board is the area where one or more types of content will be displayed: informative content, whiteboard, interactive content (questions, students' notebook, etc). The communication area will be like a specialized chat room, where students will be able to communicate among themselves and with the virtual tutor. Students will be able to chat with the virtual tutor using a predefined set of keywords and/or short sentences. To improve performance and to keep it simple, students must put a dot (.) in front of a sentence to address the VT. Without the dot, the system would assume that the student is chatting with other students.

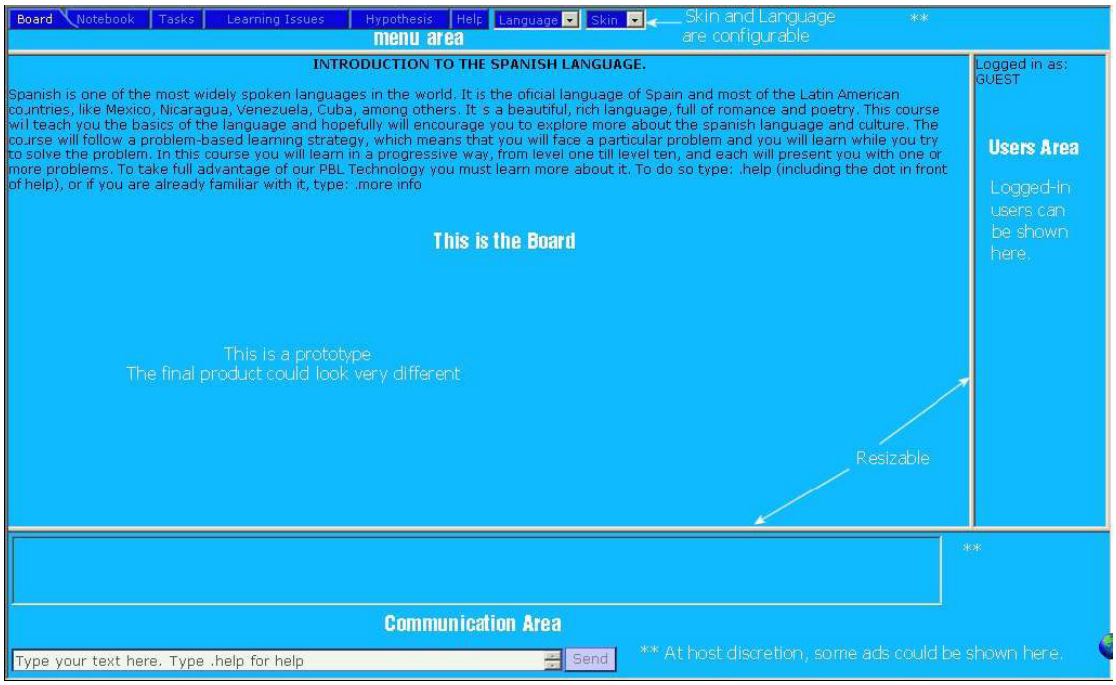

Figure 1: Classroom prototype

Lastly, the Administrative tools will provide administrative services on each of the above mentioned modules. It will be responsible for user registration, security or access control.

ATILA will be a database driven product, using MySQL as the relational database management system (rdbms). The data model (figure 2) as to how the project is supposed to achieve its programming goals is discussed in the following paragraphs.

ATILA will contain courses and users. Users will register for a particular course, and will attend a given classroom, where the course contents will be taught. Each rectangle above represents a database table. The table name is indicated at the top, with a gray background. PK identifies which column is the primary key. FK identifies a foreign key. Because there can be more than one foreign key, the symbol FK is usually followed by a number. The arrows indicate a relationship between a parent table (where the arrow is pointing to) and a child table, which contains a foreign key.

Courses can be free of charge or paid. The fee field represents the course's fee (0 or more units of a given currency). Other fields or columns are also indicated above. Users register for free with the web site and become registered users. The users table contains all the required user information. A registered user can then register for a particular course available on the system. If the course has a fee, payment information will be reflected in the course_finance and course_payments tables.

After any administrative requirement has been processed, the user will be added to the course_users table. Course users can have different roles such as creator, teacher, student, and guest. Students connect to a classroom to receive the course contents. The classroom table will contain information such as current lesson being taught, maximum number of users allowed in the classroom, course being taught, etc.

Courses are not necessarily a linear or ordered set of lessons. An ATILA course will be more like a tree, in which the travelling from node to node depends on certain conditions, such as successful completion of a task, user request for more information, among other.

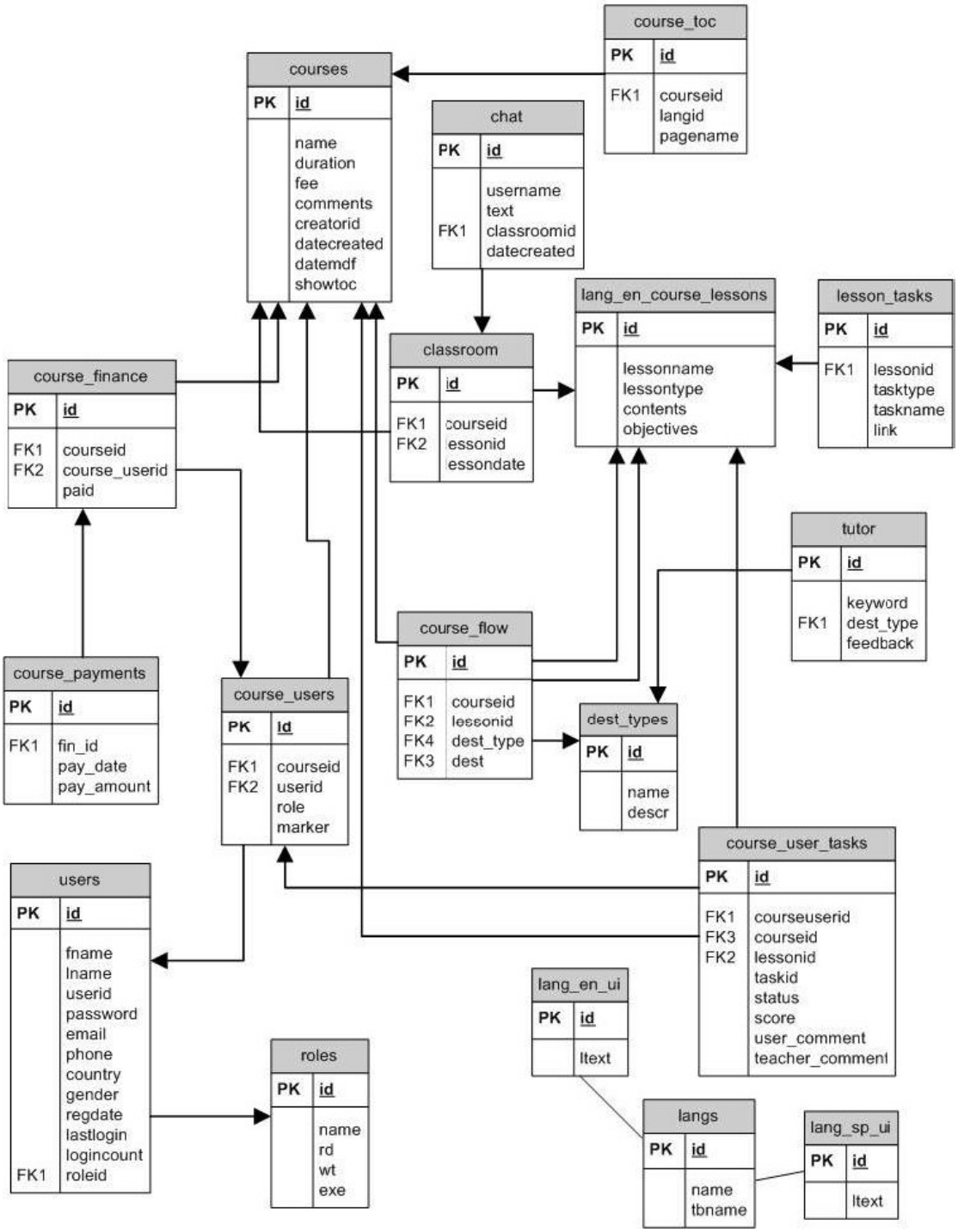

Figure 2. The ATILA Data Model.

SUMMARY OF PROPOSED FEATURES

(1) Online classroom with board, notebook, and real-time interactivity.

(2) Virtual Tutor able to provide navigational and other services. The Virtual Tutor (VT) will be able to interact with students using natural language processing, evaluate questions and tests and provide feedback to the students, compile report about students' progress for teachers or web site hosts as well as give students hints as to what to do next. The virtual tutor will become more sophisticated over time.

(3) Object-oriented software framework (core) for development of other web-based applications.

(4) Separation of application components: presentation layer, business services, and data services.

(5) Separation of user's interface elements: skin, language, and content. There is increasing evidence and policy support for the concept of mother tongue based education. Students learn better in the language environment that is most familiar to them. As such a considerable feature of this system is that it will have the ability to display interfaces, content and interactive discussions tailored to the mother tongue of each student.

(6) Provision for creation of several components of a learning system: courses, individual lessons, tutorials, simulations, and trainers.

(7) Authoring language and authoring tools for content developers.

(8) Consumer and provider of web services.

(9) Easy deployment and multi-platform, browser-based client application.

(10) Cross-cultural learning environment.

REFERENCES

Armitage, S., & Jenkins, M. (2002), 'Implementing and Supporting Virtual Learning Environments (VLES)', *ASCILITE 2002 Proceedings*

Backroad Connections Pty Ltd 2002, Effective Online Facilitation (Version 2.00), Australian Flexible Learning Framework Quick Guides series, Australian National Training Authority. [Online]. Available: http://flexiblelearning.net.au/guides/facilitation/.html

Bianchi, A.B., Busby, A.M., DeCore, J., Horsey, S., Huesr, K.H., Hill, K., & LeBlanc, V. (2003), 'Changing Places: Instructional Designers Beome Online Classroom Participants', *The E-Learning Developers' Journal*, Vol: August 4, pp. 1 – 10

Chelin, J. (2003), '*Virtual Learning Environments – Overview and Issues for Institutional Managers'*, SCONLU Newsletter, Vol. 28, Issue: Spring, pp. 43 - 47

Dale, C., & Lane, A.M. (2004), 'Carry on talking': Developing ways to enhance students' use of online discussion forums, *Journal of Hospitality, Leisure, Sport & Tourism education*, Vol. 3, No. 1, pp. 53 - 59

Deepwell, F (2002), 'Towards Capturing Complexity: An interactive framework for institutional evaluation', *Educational Technology & Society*, Vol. 5, Issue 3, pp. 83 – 90

Elliot, K., Anderson G., Irving, L., & Bonollo, A. (2001), 'Expanding the User Base of Computer Facilitated Learning Resources', *ASCILITE 2001 Proceedings*, pp. 45 – 48

Giorgini, F., & Cardinali, F. (2003), *From Cultural Learning Objects of Virtual Learning Environments for Cultural Heritage Education: The Importance of Using Standards*, [Online], Available: www.learnexact.com/download/DigiCultPaper_Final.pdf [2006, may 12]

Gold, S.S. (2004), The Effect of Software Facilitated Communication on Student Outcomes in Online Classes, *The Journal of Educators Online*, Vol. 1, Issue 1

LaPointe, D.K. (2003), 'Effects of Peer Interaction Facilitated by Computer-Mediated Conference on Learning Outcomes', *19th Annual Conference on Distance Teaching and Learning*, Vol: July

Martinez, F. (2006). 'Mr Tutor: A Powerful Learning Management System'. Available: www.softlech.com

McCahill, M.P., & Lombardi, J. (Design for an Extensible Croquet-based Framework to deliver a Persistent Unified, Massively Multi-User, and self-Organising Virtual Environment,

Nijholt, A. (2002), Computer-facilitated Community Building for E-Learning, [Online], Available: www.vf.utwente.nl/~anijholt/artikelen/icalt2002_panel.pdf [2006, may 21]

O'Leary, R. (no date), *Virtual Learning Environments*, Association for Learning Technology, [Online], Available: www.alt.ac.uk [2006, may 15]

Ong, S.S., & Hawryszkiewycz, I. (2003), 'Towards Personalised and Collaborative Learning Management System, *Proceedings of the 3rd IEEE International Conference on Advanced Learning Technologies*

Peat, M. (2000), 'Towards First Year Biology online: a virtual learning environment', *Educational Technology & Society*, Vol. 3, Issue 3, pp. 83 – 90

Prendegast, G. (2004), 'Blended Collaborative Learning: Online Teaching of Online Educators', *Global Educator*

Roberts, G., Aalderink, W., Cook, J., Feijen, M., Harvey, J., Lee, S., & Wade, V.P. (2005), *'Reflective learning, future thinking: digital repositories, e-portfolios, informal and ubiquitous computing'*, ALT/SURF/ILTA Spring Conference Research Seminar,

Sabatini, J.P. (2001), *Designing multimedia learning systems for adult learners: Basic skills with a workforce emphasise*, (NCAL Working paper WP00-01) University of Pennsylvania: National Centre on Adult Literacy