Pilot Learning Platform Project with Contents for Nanotechnology Learning Applying E-Learning Guidelines Nanolearnproject

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Abstract- The Pilot Learning Platform with contents for Nanotechnology learning applying e-learning guidelines (Nanolearnproject) is a Research and Development project (R+D) for the learning of Nanotechnology in college level for the Faculty of Engineering in Universidad Distrital Francisco José de Caldas in Bogotá Colombia.

The project show the need to build a prototype of course in Nanotechnology that contains learning objects based in 2D and 3D materials that allow the integration of contents through the Virtual Learning Platform (VLE) using this kind of new technologies, following a series of specific guidelines and a set of specifications for develop E-learning contents, and different studies and analysis to implementation of Knowledge Management Model for learning objects that allow the generation and improvement of this kind of activities in learning environments.

This is a pilot project, developed following some parameters, guidelines and research lines oriented to develop, methodologies and e-learning strategies, this project pretends are a base for the formulation of new proposals for grade and research projects to be ended.

Nanolearnproject can be visited on the web site www.nanolearnproject.com

Keywords- Nanotechnology, e-Learning, Virtual Learning Enviroment, Sloodle, Moodle, Second Life.

I. INTRODUCTION

Nanotechnology is the study and application of technology at the nanoscale, currently is an engineering branch very studied by the benefits that it can bring in the future not very distant.

It is emphasized that world powers invest a significant amount of budget in Nanotechnology studies and researches. In Colombia doesn't exists a government Interinstitutional plan to promote the research and study in this area [4], however the study of this branch is a challenge for the educative institutions which develop Nanotechnology in research groups and like a subject in some higher education programs.

In the Faculty of Engineering in Universidad Distrital, Nanotechnology is developed like a subject in a theoretical level solely, the lack of Nanotechnology’s laboratories specialized
creates the necessity of buy them, but the high costs make it impossible for a public University like Universidad Distrital.

For this reason it raises Nanolearnproject as an e-Learning proposal for Nanotechnology learning. The project focuses its efforts in the development of three essential guidelines for the successful of this kind of projects (Technological Tools, Learning Methodologies and Contents) which are supported in a Virtual Learning Platform (VLE1) that incorporate these elements created based on requirements resulting from the previous study before the implementation. Our subject of study was some Universidad Distrital students.

II. WORKING METHODOLOGY
The project is divided in three fundamental phases [3]:

Phase I Research phase: In this phase we compiled and research the information more relevant about e-learning, learning objects, pedagogies, knowledge management, Learning Management Systems (LMS), Models and Methodologies raised by the Software Engineering, Programming languages, Standards, Open Source Web 2.0 Tools for the obtaining of functional and non functional requirements, subsequently the best tools are going to be implemented in Nanolearnproject. As a result of research phase, we are going to get a conceptual base that will be useful not only to obtain technology requirements but also for didactical requirements oriented to the Nanotechnology teaching.

For the development of the theoretical framework we compile formal and no formal information. Thanks to the new trends in the Knowledge democratization, one of the doctrines that we follow was not only to research formally sources from PhD, Researchers and recognized personalities in the area but also to people with knowledge in the area that show their work in Blogs, Wikis, Podcast, Tweets and other Web 2.0 technologies. The physical media worked in the research were books, magazines, publications and the electronic media were e-books, webs, blogs, wikis, videos, podcast and slides.

Phase II Development phase: We propose a new working methodology for the analysis, development and build of the software prototype based on the combination of two methodologies:

Methodology for the implementation of e-learning projects made by Universidad de Carabobo [6].

Software Engineering development Methodologies as XP and RUP found in the previous phase. [8].

This Methodology allows the analysis, design and implementation of the Nanolearnproject web-based software, based on Standards and Quality Parameters.

For the analysis phase, we made a Requirements document based in IEEE 830 standard which is a specification document for software requirements, this document details all the user needs (Administrator,
Tutor, Student, Guest), the design was developed with UML diagrams defined by the RUP (Rational Unified Process), then we continue with the implementation phase of the prototype using the XP methodology, integrating the set of Web 2.0 tools found in the phase I that will reinforce the learning in e-Learning system.

Phase III Test and Analysis of results phase: In this phase we test the prototype with a group of students from Cybernetics III course of Systems Engineer Career in the Faculty of Engineering in Universidad Distrital Francisco José de Caldas.

III. TECHNOLOGICAL TOOLS
After the previous study, the technological tools used for project’s development are:

- **Xerte (Learning Objects Creator):** The contents in the Nanotechnology area must be develop with a friendly and intuitive interface for the user, these cannot lack of images, videos and multimedia content, because this kind of contents are the more representatives for the students, following the Pedagogical Model. Also the contents must be having a small size and allow the access to different type of users and students, this is the reason because we used the Xerte tool. Xerte was created by the Nottingham University and allow the creation of interactive contents for the learning using Flash technology. Learning objects created in Xerte are compatible with SCORM standard and it guarantees the portability between LMS systems.

- **Moodle: (Learning Management System LMS):** Modular Object-Oriented Dynamic Learning is an Open Source platform designed for management, production and administration of web courses. This is the platform with the major number of registered installations and has the major coverage in the world that made it a popular one. It was chose for Nanolearnproject because offers a variety of communication tools, learning activities, large and organized document repositories, interoperable, standardized, open and modular that allow the adaptation of different kind of tools to the course requirements.

- **Second Life: (Multi User Virtual Environment MUVE):** SL is a 3D virtual world created, modified and designed by its residents. It is considered as the Virtual world more popular and influent in the ‘multiverse’ context. SL has the major number of concurrent users. SL was chose for Nanolearnproject because offers the possibility to communicate through different tools like Chat, Voice Chat and Instant Messaging, also offers multimedia sources like photos, video and audio Streaming. Also allow the design, build and Scripting of 3D objects, where the students can use Nanotechnology virtual laboratories and manipulate nanostructures in a virtual way.

- **Sloodle: (Simulation Linked Object Oriented Dynamic Learning Environment)** Unifying the advantages offered by the MUVE and LMS technologies we found Sloodle, an open source project that uses a modular structure to integrate Moodle with SL activities, connecting both platforms through a virtual world objects and LMS modules, providing an immersive and collaborative learning experience [5].

- **Php Technology:** PHP has been used as an integrative technology of the tools previously described under a single platform known as Nanolearnproject. This technology has been powered by the implementation of other technologies.
such as Ajax, Javascript, MySQL and Web 2.0 tools such as Forums, Blogs, Podcasting, RSS, among others, focusing on the establishment of a platform trending to e-Learning 2.0 for the Nanotechnology education.

IV. WEB DEVELOPMENT

The project development is based on the architecture of the application Nanolearnproject which is divided into several layers which are:

**Learning Model Layer:** It is the layer responsible of define the guidelines and pedagogical- didactic principles inside the implementation strategy of an e-Learning project, and on this way guarantee the transference of knowledge about Nanotechnology to the student. [1]

**Application Layer:** It is the layer responsible to show to the user the information about Nanotechnology content in the learning objects through the learning model layer. It contains the entire user interface, business and services interfaces, the LMS connections and the web 2.0 external tools.

**Data Base Layer:** It is the layer responsible for storing all information about users and learning objects with contents in Nanotechnology known as LORI (Learning Object Repository).

**Infrastructure Layer:** It contains the physical and logical infrastructure, responsible of guarantee the optimum operating conditions for the hardware, software and network for the application.

**Transversal Layers:** These layers are responsible of complementary functionalities of the prototype as the Security, Operational Management and the Application Audit Process.

V. PROJECT STATUS

The base of the project was not only the requirements implicit in an e-Learning system, but also the importance of user requirements. Various studies conclude that teaching through plain text and objects without multimedia contents is a complete failure. Furthermore, it is not enough to work on a LMS and especially with Nanotechnology, which requires the use of multimedia and interactive content for teaching, this content support the learning process. For this reason, it is necessary to provide a complete system that gives the
tools and necessary content to the learner in order to have an experience that contributes in the building of that knowledge.

The Project is still in development phase portal and contents, because the feedback of the first tests show better results and allow the complement of the project. In the development we made some probes and tests with the population of Universidad Distrital students. We found interesting results, because we made surveys before and after. The results are review in the next paragraphs:

Currently the portal is oriented to e-Learning 2.0 [2], furthermore implements collaborative tools of Web like blogs, forums, wikis, surveys, focus groups, videos, web resources and online learning objects, a content management module, a module for integration and communication with other platforms, a report generation module access and interaction with the portal, reporting module feedback learning objects and a web service that ensures interoperability with other similar systems

For the use of knowledge management inside Nanolearnproject, it analyzed and evaluated some of the knowledge management models more relevant today [7], of which Andersen model is chosen as the basis for a new proposal, but adjusted to the needs of the project. For this reason it built a hybrid model for implementing knowledge management in the platform learning contents. This hybrid model maximizes the dynamics of knowledge that is generated during the user interaction with the platform and its contents, to summarize the results and generate feedback information through the compilation of experiences and evaluations, with the specific objective to integrate participants finding on continuous improvement and increased quality of learning content.

In Second Life, with the help of a group of designers, in this moment we are building a space to work in 3D environments. It plans to use three modules of work in this area:

1. Classroom Area: It is a place where gives an air of presential education to the learner, the tutor can share their experiences and feedback from the experiences of students through live virtual sessions scheduled. Thanks to Sloodle package, we can have greater interactivity using gestures, maintaining communication between users of the web platform with the 3D platform, and to use other applications included in Sloodle package that can be useful for the
learning process. Also will be made 3D objects related to the Nanotechnology area so that students have the chance to meet and interact with them, in addition, they can build and design new objects as work materials.

2. Labs area: Even in research phase, this module will provide a space that gives a wide variety of laboratory activities, experiments and interaction in various areas of Nanotechnology. Initially we are building some interactive experiences for knowledge and understanding of the nanostructures. With the tools offered in this space, we are looking that the learner can participate through dialogs, interactive structures and other elements that makes easier to the user have a closer experience with nanotechnology.

3. Museum Area: Here you will find, presented as an exhibition, some elements related to Nanotechnology. Special environments are being developed at the museum integrating some components such as images, text, animation and interactive content that the user can use. Also we may use the glossary of Moodle to supplement some definitions and make them available through the Sloodle Metagloss.

In the survey made before the development of the course, we found that most student computers met the requirements of hardware, software and network for prototype testing. After prototype testing we found that students assimilate the contents and they like the presentation of them. So, the model was implemented knowledge management in the prototype through the evaluation of learning objects delivered in the course, based on the standard evaluation method LORI3, through which students, tutors and experts had the opportunity to evaluate them. Also, tutors through the portal, they could achieve these results in real time, considered improvements and modifications to the learning objects through XERTE tool through the website. From the results obtained was performed the same analysis using data mining principles and the use of WEKA program from which derived some of the following conclusions.

V. SUMMARY AND CONCLUSIONS
Implementing Web 2.0 tools, virtual worlds and Educational Platforms play an important role in the learning experience, it contribute not only in technology but at the level of interaction management immersive-collaborative learning makes the student look more interested in participating in virtual education programs.

We performed a content compiled from various resources that contributed to the learning by their multimedia nature. The handling of 3D tools increases user interactivity with the nanostructures and a greater interest in the way of presenting the content.

We used the XERTE web tools to supply the design of learning object online and offer templates and are usable and comprehensible to an average user.

Second Life is an unexplored tool because it has not been fully exploited its potential to create, on the other hand generates distrust the use of this platform for the educational area because it is very young and lacks the models and theories of pedagogy for the learning.

When you build a course with a highly complex content such as nanotechnology, are required to motivate users and include multimedia tools to facilitate the contents assimilation.

The implementation of free software makes lower the total cost of the project development. It allows the construction of various tools that strengthened the project.

\[^{3}\text{LORI means Learning Object Review Instrument is a standard used in e-Learning.}\]
In reality, the challenge is not to introduce the New Information and Communication Technologies in the processes of teaching and learning, the challenge is to build mediators of better socio-educational relationships.

VI. REFERENCES


VII. LINKS
Second Life
http://www.secondlife.com

Moodle
http://moodle.org/

SLOODLE. Simulation Linked Object Oriented Dynamic Learning Environment.
http://www.sloodle.org/moodle/

XERTE
http://www.nottingham.ac.uk/xerte/