APPLICATION OF A REFERENCE FRAMEWORK FOR INTEGRATION OF WEB RESOURCES IN DOTLRN – CASE STUDY OF PHYSICS – TOPIC: WAVES

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ABSTRACT

Previously a framework for integrating web resources providing educational services in dotLRN was presented. The present paper describes the application of this framework in a rural school in Cauca – Colombia. The case study includes two web resources about the topic of waves (physics) which is oriented in secondary education. Web classes and educational resources are designed for a group of 35 tenth graders using the LMS. The academic performance was compared with a second group of 35 students oriented in the traditional way. The objective is to compare the academic performance and effectiveness of using LMS during the educational process.

KEYWORDS

E-learning; services; integration; reference framework; Web resources; learning management system

1. INTRODUCTION

The progress of information and communications technology (ICT) in education has led to the emergence and positioning of Electronic Education or E-learning [2] supported by learning management systems (LMS). An LMS is a tool that performs among other functions: mediation of knowledge appropriation, administration of such mediation, access to educational and communication tools. By using LMS, educational institutions provide distance learning courses and educational services to more students. This online education facilitates access to those who cannot move to the physical classroom classes [3]. In our region, universities provide support for undergraduate and graduate courses using diverse technologies: the University of Cauca for example uses "dotLRN"[1], and the University Foundation of Popayan uses Moodle[2].

Two of the most used LMS are Moodle and dotLRN [17]. Moodle is a free software package based on pedagogical principles and allows the construction of online learning communities. dotLRN is a "business" free software platform to support e-learning and virtual communities. Although the best platform for an depends on the requirements of each institution [4], dotLRN offers many advantages associated with its business approach [5] [6]

The integration of Web resources within LMS allows reuse of content available online and promotes the quantity and quality of educational services that can be provided by the LMS. Likewise, the integration of Web resources avoids student distractions as they don't need to surf the internet searching other educational web resources. If web resources are integrated into the LMS, the students don't need to leave the platform during the learning process, and consequently, the students may stay focused and save time. Numerous studies exist on the integration of Web resources such as educational services in Moodle platform. However, few works integrating Web resources in dotLRN can be found [1]. This integration presents significant challenges because of the architecture and the programming language used in dotLRN. Previously, a review of the state of the art on the different technologies to integrate Web resources in dotLRN was presented [7].

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[1] http://dotlrn.org/
[2] https://moodle.org/?lang=es

Equally, the framework for integrating Web Resources in dotLRN and the architectural guidelines to incorporate web resources are described elsewhere [8]. This framework has been tested in other areas [20]

In this article, the implementation of this framework for integrating web resources as e-learning services in dotLRN in the topic waves (Physics course) is presented. The paper is organized as follows. Section 2 presents a summary of the Framework. Section 3 describes the case study. Section 4 and 5 depicts the results and conclusions.

2. FRAMEWORK FOR INTEGRATION SERVICES WEB RESOURCES AS E-LEARNING IN DOTLRN

2.1 Learning Management System dotLRN

DotLRN focuses on facilitating communication between actors in the learning process. DotLRN users can share documents, manage users and communities. One important element of our research is that dotLRN platform offers many tools to interact with external agents. This functionality opens the possibility of interaction with other LMS and external Web resources [9] [10] [11]. The framework for the integration of web resources such as e-learning services in dotLRN [7] defines the requirements and architectural guidelines for integrating web resources within dotLRN. DotLRN offers the following services [12]: Calendar, Blog, Documents, Wiki, community management, content repositories, forums [13], Member List, FAQs, Internationalization i18n, Authentication [14] [15], tasks, tracking, object repository, Photo Album, WebDAV, E- Commerce, Wysiwyg - web editor, AJAX [16].

2.2 Web Resources

In the context of the present research these three concepts are defined:

Framework: Articulation of three elements: 1. A conceptual framework; 2. Architectural Guidelines 3. Validation of these guidelines through a case study.

Resource Web: elements identified by a URI (uniform resource identifier) hosted online and accessed using a version of the HTTP protocol according to the ISBD ER (Standard International Bibliographic Description) and W3C (a consortium of the network around the world).

E-learning services, information services under service architecture (e.g., Google Docs or Google Forms or other Web 2.0 as a platform for educational activities) [18] [19].

Most of the Web resources are accessed using HTTP protocol. This feature allows interacting with different technologies such as flash, java, javascript, HTML, html5, Web 2.0, etc. Due to the fact that many educational resources based on HTTP can be found, it is necessary to set minimum requirements to ensure integration with dotLRN [8].

During a course, a teacher may see the need to include services not present in the LMS. DotLRN solves this need by using applets, portlets, and packages. For this reason, the integrating of Web resources in dotLRN is based on these three elements: 1: Package: Contains the data model, the logic and the operation of the package. Equally, it integrates the user interface of the package. During the integration, in this element, the programming is done to reference the URL of the Web resource. 2: Portlet: Provides the user interface for the portals of the platform. In this element, the graphical interface of the package and its management is defined describing the Web resource linked to the package. 3: Applet: Uses the interface of the portlets and set the properties for the dotLRN portal. This functionality allows administrators and teachers to add applications to the course.

2.3 Reference Framework

This section describes the clue aspects of the framework for the integration of educational web resources dotLRN. The detailed description, as well as the validation, may be found elsewhere [8]:

2.3.1 Requirements for the Integration of Web Resources into dotLRN

The requirements to ensure the integration of web resources dotLRN are the following:

1) Resources must be identified by a URL. 2) The whole Web site to which the resource belongs shouldn't be integrated. 3) The displaying size of the resource must be considered. The resource must be incorporated into the Web site dotLRN, and limited space is available. 4) Extra features (flash, java, javascript, html5, Web 2.0, etc.) must meet the above requirements. 5) Web browsers must support the necessary plugin to run Web resources. 6) The Web resources must provide learning functionalities to the dotLRN course.

2.3.2 Architectural Guidelines for the Integration of Web Resources in DotLRN

The guidelines to be followed for the integration of Web resources that provide services e-learning in dotLRN are the following: 1) Create the package using the Package Manager, 2. Program the package to reference the Web resource to integrate. 3) Create portlet directories and applet. This task is done automatically using Nima Mazloumi script. 4) Set the portlet to describe the Web resource and link to the package. 5) Set the applet only if necessary. 6) Install the applet and the portlet through the installation tool dotLRN software. 7) Finally, the application is available to be added in a course from the option "*Manage applets.*"

2.4 Implementation of the Reference Framework

Two educational web resources associated with the topic of Waves (Physics) were integrated and evaluated during the case study. For purposes of this implementation, it has created a virtual course, a teacher and 35 students on the platform. Table 1 shows the verification of the requirements to integrate services performed since it is the first thing that must be done to comply with the framework:

Table 1. Verification of integration criteria - Web Resources

#	Criteria Integration	Web Resources	
		1	2
1	The resource has a URL	Yes	Yes
2	Identification of the URL of the resource	Yes	Yes
3	display size checked	Yes	Yes
4	Compatible functionality with HTTP	Yes, .swf, simulator	Yes, .swf, simulator
5	Compatibility with most browsers	Yes	Yes
6	The resource supports a learning process	Yes	Yes

2.4.1 Execution of Architectural Guidelines for the Integration of Web Resources dotLRN

The following steps were performed according to the guidelines previously described:

1) Create the package using the Package Manager: The package name was "Física_Décimo (Physics 10th grade in English)" and aims to integrate two web simulators in the LMS. 2) Program the package to point to the web resource: Here the necessary files are created in the package directory "ondas" (Waves in English) (... / Física_Décimo / www / ondas). 3) Create directories portlet and the applet using the script (code to run) Mazloumi Nima. After running the script, the directories generated (/ usr / share // packages) were copied taking into account the privileges of reading, writing and owner of the operating system. After this step, the package directory contains three application directories (Waves, Waves-portlet, and dotLRN-ondas).

4) Set the portlet to describe the web resource and link the package. 5) Set the applet only if necessary. For this case, it is not required since the applet generated meets the requirements worked in the portlet. 6) Install the applet and the portlet: Through the software installation tool of dotLRN in InstallFrom Local option -> Service -> ondas applet selection. 7) Finally, the application is available to be added in a course from the Manage applets option on the Admin portal course by the teacher in charge.

2.5 Verification of the Implementation of the Framework

After an implementation of software (dotLRN) in the hardware (server), it is necessary the verification using the client access (teacher and student):

1) Verify that the new applets appear in the list of available applets. 3) Verify that the *Waves educational web resource* appears on the course home page. 4) Verify that the *portlet package management* appears in the course administration page. The two web resources integrated into the case study are simulators. The students can interact to strengthen their knowledge regarding concepts of tension, damping oscillation pulse amplitude, among others, the figure 1 and 2 the two integrated web resources.
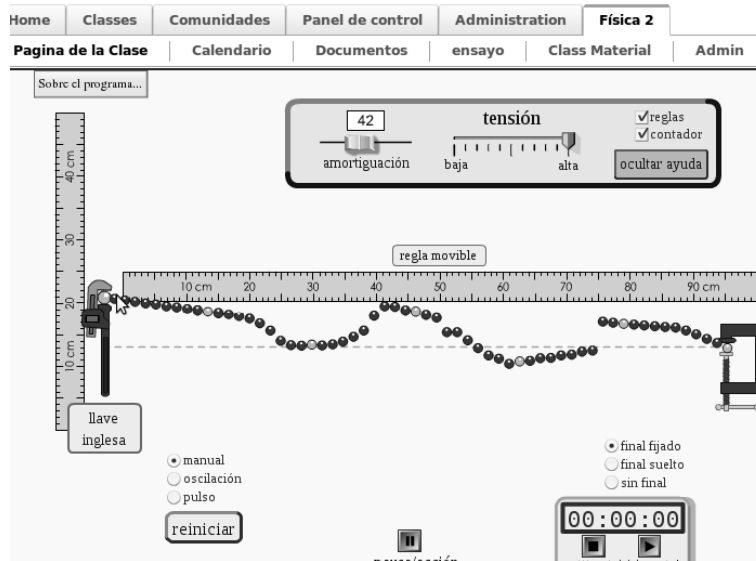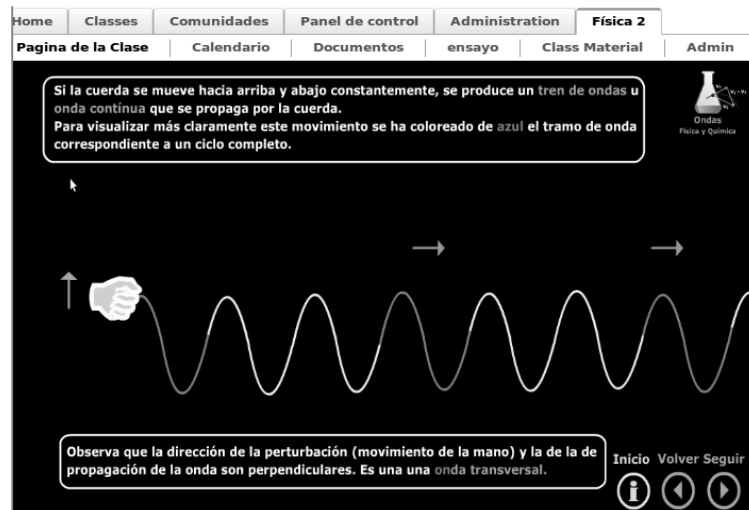

Figure 1. Web Resource 1

Figure 2. Web Resource 2

3. CASE STUDY

3.1 Context of Study

The implementation was done in the Jose Maria Cordoba school. This school is located in Mondomo, municipality of Santander de Quilichao (Cauca Colombia). The emphasis of the school is environmental and business education. It has approximately 600 students from sixth to eleventh grade. The proposed framework was used in a physics course for 10th Grade. The course has a total of 70 students. 35 students were guided in mode B-Learning (Group A), and the other 35 were guided using traditional methods (Group B). The evaluation was done to compare the academic performance and verify the impact or of the use of Web resources during the student learning. This process is done by working sessions of the research team, faculty, administrators, and students.

3.2 Implementation of the B-Learning Process

3.2.1 Day 1: Management of the Platform

With the teacher: some details about the platform and the Web resources are described. Equally, a basic training about dotLRN is oriented. The elements covered were: access to the platform, registration, login, available courses. Equally the basic elements of courses: activities, forums, materials, assessments, calendar, email, students, and integration of educational web resources by aggregating applets.

With students: training is done to register on the platform, access and interact with courses and Web resources. Equally, some training was done about forums and online questionnaires solution.

3.2.2 Day 2: Definition of the Teaching Methodology

The methodology to be applied to Group A is defined. It is intended that the methodology was close to the methodology used daily in the classroom, thus the research group and teaching methodology CONCERT the following steps:
   • The course platform is named according to the subject to which it applies: Décimo_Física
   • The teacher explains the theory of the subject in a conventional manner (board, beam video, exposure, and interaction with the student).
   • In the virtual course, the courses and web resources are integrated. These contain textual, multimedia information, practical and simulates an interactive process with the student.
   • A reasonable time is given to the student to interact with resources. These resources support the conventional educational process.
   • A forum activity is proposed on the platform.
   • The teacher proposes a workshop with a series of questions on the subject. This workshop is solved with the help of educational resources.
   • The teacher reviews the workshops, socialize and clear up doubts.
   • An activity examination is implemented as assessment. This evaluation is based on evidence-based know 11 (knowledge measurement system applied by the Colombian Ministry of Education). The assessment questions have single or multiple answers
   • Finally, the results of the evaluation are analyzed and compared with students who did not receive B_Learning method.

3.2.3 Day 3: Application of the Proposed Methodology

The class was developed during 3 hours in the computer room where each one of the 35 students has a computer connected to the LMS.

Relevant classroom observations regarding students: increased attention, concentration, interaction, less indiscipline, greater participation, a fluid management platform and its modules required (e-learning resource, forum, and evaluation). Students were enthusiastic about the two simulators; they mention that the topic is clear, and the resources help to clear up doubts.

Relevant classroom observations regarding the teacher: from the responses in the forum, the teacher observes that the students were more efficient, fast and motivated. The 35 students developed the workshop correctly.

The teacher expresses: "optimizing the understanding of students is very important, the assessment using the forum allows know the learning of each student and his motivation. The results are satisfactory compared to those obtained in a conventional manner. "

At the end of the day, a survey was applied to students to determine the satisfaction and efficiency of the approach.

100% of the students like to use the computer in the learning process. 90% considered easy to enter to the platform. 100% considered easy to find the resource suggested by the teacher; this issue avoids distraction and greater concentration. 80% considered easy to integrate the LMS service. 100% understood the topic. 100% would like that all teachers will use this tool to their classes. 85% consider excellent the use of ICT in education and see the need for more computers and higher bandwidth.

4. RESULTS

4.1 Evaluation of Results

This section describes the results obtained in the case study. The following tasks were accomplished:

Platform installation, the creation of students and teachers, integration of two web resources, no performance drawbacks or technical platform were presented, good management of the platform is performed by students and teachers for each one of the functions needed.

On the other hand, an impact analysis in academic performance with the teachers involved in the two subjects in a fourth day is done.

4.1.1 Day 4. Analysis of Assessments

The results of the student assessment groups A (B_Learning) and B (conventional classes) are shown in Table 2.

Rating Scale: 1 to 5: Low: 1.0 to 3.0; Medium: 3.1 to 4.4 High: 4.5 to 5.0

Table 2. Students assessment analysis

Group	Evaluation (# of Students)			Percentage performance analysis (%)		
	Low	Medium	High	Low	Medium	High
A	5	7	23	14%	20%	66%
B	12	16	7	34%	46%	20%

In Figure 3 the percentage analysis of student assessment according to the scale used (low, medium, high) is presented
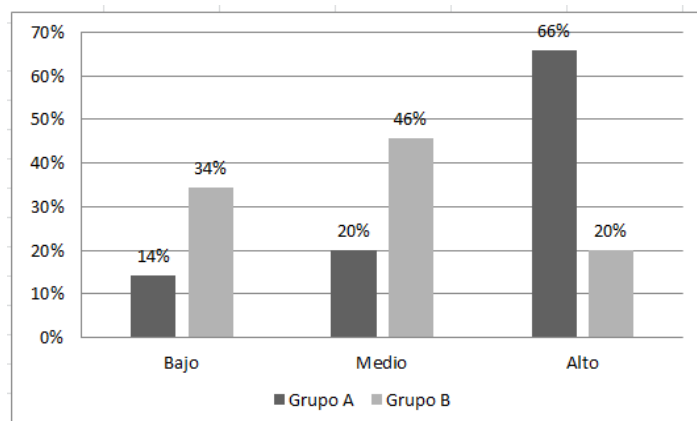

Figure 3. Percentage analysis evaluation

Table 3 shows the results of the approbation by group of the 70 students.

Table 3. Students approved or not approved

Group	# approved	% Approved	# Not Approved	% Not Approved
A	30	86%	5	14%
B	23	66%	12	34%

In Figure 4 the percentage of students who passed is plotted and who failed
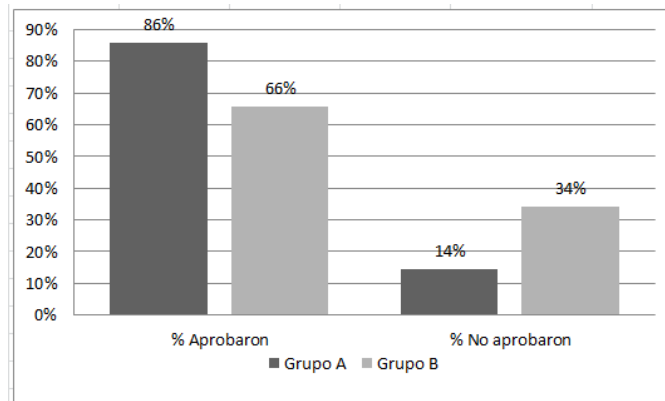
Figure 4. Percentage analysis of students approved or not approved

4.2 Performance Analysis

70 students were divided into two groups, Group A: use the LMS with the web resource being integrated, and B. Group receives traditional instruction. In group A, only 14% had a low performance while in group B 34%. In group A, 20% had an average performance while the B 46%. In group A, 66% get high evaluation while in group B only 20%. In summary, 86% of students in group A passed the assessment, while in group B only 66%. In group A, only 14% did not approve the assessment while in group B 34%.

5. CONCLUSIONS AND FUTURE WORK

The use of the LMS integrating Web resources has been well received in the educational community (teachers, students, and managers) of the school of the case study. The approach attracted high interest. The teacher says that improved performance is evident in students using the platform. The academic impact of students is positive in those who used the platform compared to those who did not use it. With the integration of resources greater concentration of students is obtained since it is not necessary to leave the platform to use other Web resources. The framework for integrating external services in dotLRN allows reusing more and better resources in the platform supporting educational processes. Future work will focus on integrating Web resources into other LMS, such as Moodle. Additionally, the framework will be implemented in other educational institutions with different students, such as indigenous [21], Afro-Colombian and urban.

6. FINANCING

ACKNOWLEDGMENTS

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