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Instrument for the Evaluation of Learning Objects (IELO)

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Abstract— The university incorporates innovative instructional resources in order to provide additional tools to access information and activities for the teaching of mathematics, including learning objects, they must have a quality design related to their own characteristics but without an assessment tool would be difficult to determine, thus resulting in the need to develop such a tool. This article let's compare the level reached by an object within a scale, this proposal takes a first iteration so far has been used for evaluating Learning Objects in University Center UAEM Valle de Chalco and presents the theoretical foundations and structure Instrument Assessment Learning Objects (FELO) through four main areas to determine its quality : instructional design, content quality , technical aspects and user interface. The instrument is based on the classification of the proposed methodology based on an analysis of four existing, considering further learning style. In this sense, the work is a contribution to the field of educational technology provided a methodology for creating LO by academic standards and technical quality. The article describes how each axis has been interpreted in the assessment of LO.

Index Terms—educational resources, learning object, mathematics teaching.

I. INTRODUCTION

The use of technology applied to mathematics education facilitates the development of didactic activities, thus supporting the advancement of the field of study associated with the mathematical knowledge that teachers intended to convey the university student to rebuild this learning supported by findings from employee training materials, taking responsibility over their own learning without substitute teachers in their role of educating. The teaching material is conceived not only as the conjunction of a collection of content in the form of Learning Objects (LO) with a pedagogical strategy, defined by an instructional design that guides you through the education process, but as reinforcement in the process teaching and learning also are supported by web platforms mostly concentrated resources for teaching, learning and research [1], reside in the public domain or have been published under an intellectual property license that permits their free use is for other people.

Examples are the web portal of the University Center UAEM Valle de Chalco, <http://cux.uaemex/cursos> that is managed by Moodle and Open Course Ware (OCW) site of The National Distance Education University (Spain), in both cases the educational content is developed by teachers for open use to students enrolled for the course, in each one of them has a methodological and instructional design based on true educational model.

II. PROBLEM DESCRIPTION

One of the biggest problems is that the university gets a higher average poor education in which no basic knowledge axles are designed in algebra, calculus or statistics to name a few, with the need to rely Environments Virtual Learning, EVA [2] LO and also support the use of online educational content, specifications and standards make them interoperable and reusable for different applications and learning environments [3], allowing the teacher-student duo decide from different educational proposals which suits the purposes of the subject or topic in question Do the items chosen based on the methodology proposed are sufficient for the computational model proposed by the teaching material is functional as a tool for teaching as same tool the student in developing specific topic in the area of mathematics? Precisely is part of the evaluation by the expert to LO to determine what elements lacking in their development so as to redesign from the necessary requirements to be housed in the Repository.

Repositories are intended that resources are discovered, for construction testing several prototypes of objects is required, populate the repository with different types of content to test its performance, interoperability, resource recovery and robustness, they hosted in the repository were labeled before following a metadata standard, which allows the user to select certain criteria from among all of them (ibid.).The authors of the accepted manuscripts will be given a copyright form and the form should accompany your final submission.



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III. SCOPE AND LIMITATIONS

Project financing for the teaching of mathematics has contributed to the development of education, presenting as increased fruit production of educational materials, which as indicated Astudillo [4] have promoted the emergence in recent years of repositories concentrating valuable resources for teachers, students and educational institutions, though these are static type, i.e. from metadata (tags that distinguish one resource) show generally educational materials without providing a limited recommendation among them and that in turn ensure cover the key points without running all. The Department of Mathematics Education Center for Research and Advanced Studies (CINVESTAV-IPN-DME) National Polytechnic Institute and the University Center UAEM Valle de Chalco working on the proposal for a project called Project Teaching Calculus (AQAP) which in after four specific projects, one covers - Webinar Teaching Calculus (SECAL). 2 - International Conference on the Teaching of Calculus (EICAL), 3 - Magazine Calculus and Teaching (RECALE) and 4 - Platform Educational Material and Software (PMSE). These projects are complemented and are the collaborative work of several national and international institutions reviewers [5].

The University Center UAEM Valle de Chalco in 2005 initiated the project "Development of educational software for learning conceptual calculus," which considers the teacher-student-relationship software; providing educational tools online as it is VirtualMat, a virtual site for learning math, and through the years he has worked in the construction of new proposals Learning Objects area of mathematics:

Object 1, Barrel: This application is to address high-low differential calculus course.

Object 2, Ballon: This applet theme are serving radio, volume and height of the container, and water balloon.

Object 3, Ixoperimeter: Includes theme ixoperimeters maximum area and unit derived from a real function in the course of differential and integral calculus.

Object 4 Pulleys: Application for the development of interactive lessons for learning math functions.

Achieving in 2011 its own assessment learning objects for a calculus course, viewed from the context of university level course in Computer Science and Bachelor of Administrative Computer Engineering, the assessment is aimed at measuring quantifiable aspects and elements representing the quality of the learning objects viewed as an educational software product, using the Internet as resources, applets and CalcVisual educational software, without changing the official curriculum and syllabus content; in order to have instruments measuring the quality of LO area of mathematics and the subject specific calculation as part of the PMSE. Betting that current technologies and new teaching methods achieve a substantial change in the campus, teachers, students and researchers involved in generating new content and complete courses based on the Differential and Integral Calculus with homogeneous characteristics and standards; these can be used in distance learning, face or blended promoting understanding of the concepts of calculus [6]. However, a major limitation is that currently both the Center for Research and Studies of the IPN and the University Center UAEM Valle de Chalco do not have a database containing training materials; with what comes home at least have a model focused on assessing LO repositories. To understand the functionality of the proposed model, then the script development considerations in the creation and operation between its components is described.

IV. METHODOLOGY PROPOSED MODEL

The process consists of four stages, the first deals with the investigation concerning learning objects and their labels and the operation of open and closed repositories; the second stage directly attacks the logical operation of the repository; the third addresses the analytical and critical insight into the performance of the classifier algorithm LO, test standard repository system that hosts resources for data collection and given preference in use. The fourth and final stage will take the experimental part and when applied to characterize the profile of the student and the LO that apply to them. Figure 1 illustrates the display of the model applied to the repository and in the exercise, its operation and how its elements (subsystems) for LO recommendation interrelate.



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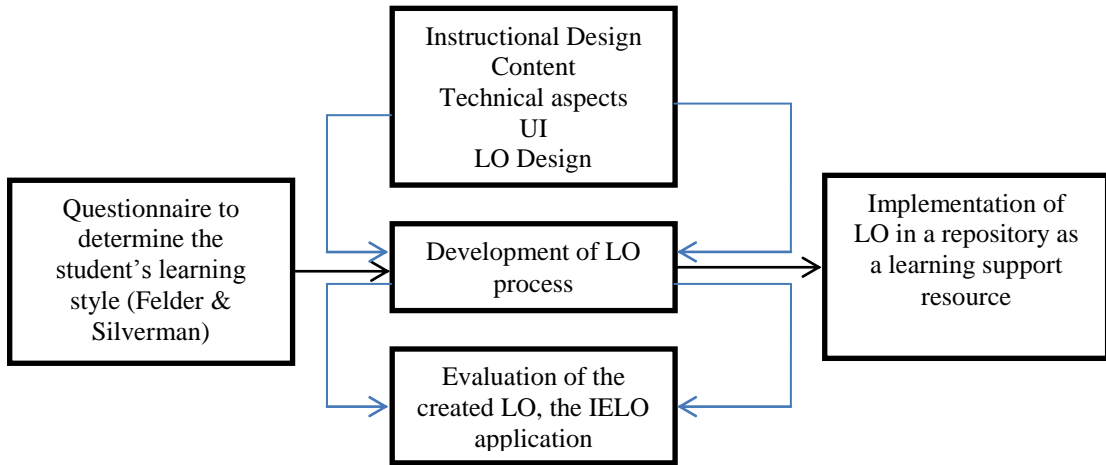


Fig. 1. Evaluation of the quality of LO

V. OBJECTS ASSESSMENT IN THE UNIVERSITY CENTER UAEM VALLE DE CHALCO

The assessment is posed when pre-student interaction, so that the assessment within the development process of the object is allowed, providing security to provide quality resources to students. The next step was to construct the instrument for the assessment of LO called IELO (Instrument for the Evaluation of Learning Objects) shown in Table 1, in which four main areas were considered:

1. Instructional Design
2. Contents
3. Technicalities
4. UI

The IELO part of the process of development of LO, which is characterized by being iterative in the sense that an object can be evaluated and redesigned, as many times as necessary to obtain the desired level of quality.

A. Instructional Design and Content: collaboration gives expert in content, instructional designer to establish criteria to determine whether the LO is related to the objectives of the curriculum and teaching in context where applicable.

Title LO: _____
 Treated Theme: _____
 Skills developed: _____

Table 1. Instrument for the Evaluation of Learning Objects (IELO)

Item	Very Good 4	Good 3	Regular 2	Bad 1	Very Bad
	points	points	points	point	0 points
1. Instructional Design					
Presents a title					
It has a clear learning objective and explicit					
The indications are precise (instructions)					
The proposed activities are consistent to the educational level of the context for which the LO was created					



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Individual work is encouraged by students					
Contains activities and / or exercises in which the user must produce something (they are interactive)					
Proposed examples and practical application					
It presents some form of assessment					
There is congruence between objective of learning, the activity (activities) and evaluation					
Logical structuring of content					
The contents are considered to be in force (updated)					
It features a design according to different styles of learning					
2. Content					
The resources used and the information is cited and referenced correctly					
The sources of information used are verifiable					
Comply with grammatical rules (wording and spelling)					
It has the information necessary to perform the activity, and the instructions are clear.					

B. Technical Issues: Standardization is given allowing the contents to be interpreted and executed by systems that are aware of the standards that were defined metadata. This treatment packing or encapsulate the teaching unit in LO, is a technical task assisted by a specialist when it comes to define the metadata.

3. Technical issues					
Specifies the minimum technical requirements for use.					
The main file can be identified easily and the Organization of the files that make up the LO is clear.					
Compatibility with different browsers					
Compatibility with different operating systems.					
Speed for the LO of audiovisual resources					



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It applies a model packaging					
It applies some standardization model, SCORM or other.					
Is stored in a repository					

Item	Very Good 4 points	Good 3 points	Regular 2 points	Bad 1 point	Very Bad 0 points
4. User interface					
The text is readable in a clear manner (for users with visual impairments).					
The visuals bring added value to the text					
The visual composition and interface design is nice (color, animation, distribution and resolution) and does not hinder the achievement of the educational objective.					
Distribution of resources (textual and audiovisual) within the content					
LO has a navigation system among contents (Menu or links between content)					

C. User Interface: The alignment of the previous three stages to be shown and delivered to the user is given LO requires the support of specialists in graphic design, interfaces, ergonomics and web programming.

The criteria and the categories in which are subdivided have the opportunity to be weighted. Each reagent can take the values (Likert scale):

- 0: Very bad
- 1: Bad
- 2: Regular
- 3: Good
- 4: Very Good

While the ranges of values representing the average rating on a scale of four points are:

- From 0.0 to 0.5 Very Bad
- From 0.6 to 1.5 Bad
- From 1.6 to 2.5: Regular
- From 2.6 to 3.5: Good
- From 3.6 to 4.0: Very Good

The criteria included in this assessment are associated with quantitative weights, allowing an objective assessment of quality through the relevance of content and aesthetics presented; the instrument also allows tracing LO quality of various subject areas in at a higher level teaching.

VI. CONCLUSION

The contribution of this stage of the project to the experts came to have a methodology as a standard in the assessment of LO, it allows to determine from where it is necessary to restructure the qualified object, thus helping in the teaching and learning of mathematics at a higher level through the recovery and well-defined teaching LO recommendation metadata (tags) allowing their classification. The contribution to the field of educational technology is given in a methodology for the development of LO, a validation of a method of assessing LO is provided. The next step is to label and package the items evaluated.

VII. FUTURE WORK

It is expected to validate the LO recommended by experts from the perception of users (university students) to make the final version of IELO (Fig. 3).



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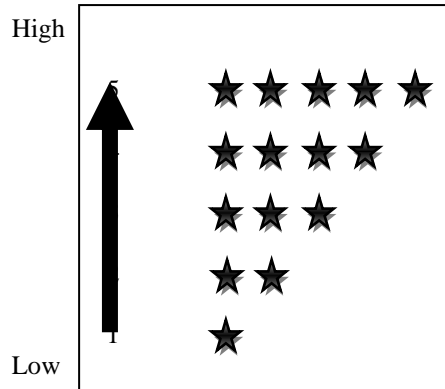


Fig 3. Appreciation Scale Ratings

- 1 - LO not functional
- 2 - The LO is not functional but I think it has serious content
- 3 - The LO could be used as a teaching tool, but I think it is so interactive, merely display information
- 4 - The LO was useful as a teaching tool but requires some minor adjustments
- 5 - The LO was useful as a teaching tool and requires no adjustments

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