

A Framework for Learning Object Evaluation (FLOE)

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It is frequent to question ourselves about the quality of the objects (Learning Objects), because these dynamically break old paradigms on the individual and collective formation. The concept of Learning Object leans on the idea of "contents" or "digital resources". For Wiley [33] a Learning Object is "any digital resource that can be reused to facilitate the learning". But, what happens if the digital resource is not of quality? We are exposed to learning situations where the educational objectives to be achieved, through the technological and curricular innovation, are not reached. Therefore, the main objective of this paper is to present a model and its experimentation for the evaluation of objects (Learning Objects) where the quality is studied through four aspects: positive quality, negative quality, delivery, and formative quality.

Key words: ITC, evaluation, Learning Object, E-learning, object, Portals.

1. Introduction

Objectively, there is a need to increase the supply of curricular updates and continuous education available in the most varied conditions and circumstances, for an each time greater community of specialists and participants in the virtual educational surroundings [2], [13].

For this reason, we hope that this proposal causes the evaluation and classification of the Learning Objects in the technologies of the Information and the Communication, considering the interaction of the participant with the object in aspects like: accessibility, usability, didactics, pedagogy and learning, and use of the Information and Communication Technologies [1].

The purpose of evaluating the objects is to construct the basis for later expositions that will allow to give answers to the limitations exposed by [16], [28], [18], [17] and that are exposed next:

- Techniques of the virtual surrounding.

- Personal characteristics of the students and the professors.
- Abilities for the use of the new information and communication technologies.
- Capacity to adapt to the new learning surroundings.
- Contents that have to be learned.
- Methodologies of education-learning.
- Multimedia resources.
- Interactions between professors and students.
- Quality of the pedagogical designs.

Currently, the technology of Portals and Learning Objects are used to instruct and to inform [13], [2], [22],[19] changing the form how the educative contents are imparted. Sciences that previously, due to their level of complexity or sophistication, were not enthusiastic towards these modalities of learning, today enter in virtual education topics and surroundings. Therefore, in the first section of this article, the characteristics of the Learning Object by Wiley [33]; and the opinion of specialists in subjects of Portal [7], [8]. Next, the Model of Evaluation for Learning Object is described; later, the framework for the

evaluation of a Learning Object is presented. Finally the conclusions and future works.

2. Learning Objects in Portals

The portals are instruments of search, navigation, help, and personalization. They allow the users to personalize their information sources choosing and taking only the information that, they find personally useful; including if related to private information [7], [8], [5].

In[29] a portal is:

- A door or an entrance. It provides access to the information, also to a link, specialized and focused.
- A filter. It eliminates from our trajectory the information that is not relevant.
- An Ad hoc announcement. This allows its definition to happen at the moment of use rather than at the time of design. Its definition is specified by the user. The Portals are modified for particular requirements.

A Portal is individualized when a user can specify its behaviour, aspect, and content..

A Portal is a channel between the supplier and its customers.

The Portals, [13] [2], [22], [15], [19] offer a wide variety of Learning Objects arranged to facilitate knowledge. Many of these objects that interact within the technological infrastructure of Portals are described through Wiley [33]. A Learning Object must have the following characteristics:

- Number of combined elements.

The number of individual elements (such as video clips, images, etc), combined to make the Learning Object are described.

- Type of objects included.

Describes the type of Learning Object that can be combined to form a new Learning Object.

- Common Function.

Describes the way in which the type of Learning Object is generally used.

- Additional dependence from the object.

it describes if the Learning Object needs the information (like the location in the web) about other Learning Objects, with the exception of itself.

- Type of logic contained in the object.

It describes the common function of the algorithm that constitutes it and the procedures of the Learning Object.

- Potential of the context for inter-re-use.

It describes the number of the diverse learning contexts in which the Learning Object could be used. This is, the potential of the object for re-use in diverse areas or domains.

- Potential of the context for the intra-re-use.

It Describes the number of times in which in the Learning Object could be re-used in the same area or appropriate domain.

Without doubts, these characteristics allow to have a more specifics idea on the scenarios in which the Learning Object are based and thus, to deepen in the quality that these must have in the portals. Currently, aspects that occupy and concern the experts in E-Learning is the definition, elaboration and use of the denominated "shared or re-usable learning objects" (Sharable contents objects or Reusable Learning Objects), The share or re-usable learning objects allow to form bases of didactic contents (Learning objects repositories) that can be used in different educative contents and for different addressees, with the respective economic and effort saving, and with the added advantage of being able to be reused by many users of E-learning [30], [18].

As a previous step to its reusability, we propose a framework to evaluate the quality of the Learning Objects based on four scenarios: positive quality, negative quality, delivery and formative quality. In the following section we explain in what the framework of this proposal consists to guarantee quality in the Learning Objects.

3. A Framework for Learning Object Evaluation (FLOE)

The interest for evaluating the Learning Objects is suggested by authors like [23], [21], [20], [6]. Based on their questionings we study the optimum levels in aspects such as usability, accessibility, and learning in the Learning Objects. Similarly, a model to evaluate a Learning Object from the environment of the portals is proposed. In it, the perspective of quality of the Information and Communication Technologies [1] is analyzed, managing to determine its worth as an object that provides learning and, subsequently, knowledge to the user of the Learning Object. For the development of this model, we utilize the Cobit's evaluation objectives or criteria[9], for the Information and Communication Technologies [1]; and the model proposed by Kirpatrick [12] for the evaluation of traditional formative actions, that, currently, various authors recommend their adaptation and use in E-learning[4],[25],[27]. Subsequently, are developed the four scenario of study of this proposal (see fig.1. Evaluation Scenarios).

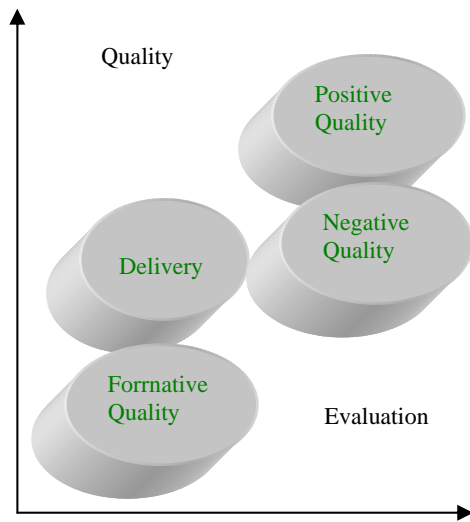


Fig.1. Evaluation Scenarios FLOE.

The criteria utilized permit to formulate general scenarios. From them, we obtain specific scenarios to build an experimental model for the evaluation of Learning Objects. The general and specific scenarios for the evaluation of Learning Objects are the following:

Positive quality: It examines the quality of presentation and visibility of the information. It integrates three specific scenarios:

- Velocity: the ideal state of the information in real time is evaluated.
- Simplicity: the simple integration in the interface is evaluated.
- Utility: a conceptual model of representation, interactive, comprehensive, to improve the sensation at sight is evaluated.

Negative quality: Belonging to the quality of the applications of Information Technology that are transparent to the users. It contemplates three specific scenarios:

- Completeness: information without error and without duplications.
- Accuracy: correct, exact; captures exactly the state of the resources.
- Authorization/Validation: continues the intentions of managements to protect them against unauthorised modification.

Delivery: Comprehends how, when, and why the information technology is made available to the user. It comprises three specific scenarios:

- Availability: accessible and useable when is required.
- Confidential: it communicates only to the ones that have the right or need to know.
- Autonomy: independent and easily replaceable.

Formative quality: Examines the efficiency and effectiveness of the framework of learning of the specific scenarios that are: reaction, learning, transfer, and impact.

- Reaction: Treats the impact that the user perceives from the elements of learning, like the educator, the contents, the materials, and the learning.
- Learning: is evaluated to verify the level of knowledge and abilities acquired by the user.

- Transfer: consists of detecting if the activities developed permit to achieve a formation inside the work environment.
- Impact: It is intended to identify if the lack of training has a negative effect in the organization or on the user.

The model proposed was developed to evaluate the Learning Objects from the perspective of the ITC-USER, ITC-LEARNING and user-learning, in the environment of the portals. It also evaluates the knowledge and learning that is produced from the man-machine-learning-knowledge combined interaction.

4. Evaluation Scheme for FLOE

The purpose of this scheme is to develop the experimentation of FLOE . (See Table.1 Scheme for the evaluation of a Learning Object)

L O	Positive Quality			Negative Quality			Delivery			Formative Quality			
	Velocity	Simplicity	Utility	Completen	Accuracy	Authorizati	Availability	Confidentia	Autonomy	Reaction	Learning	Transfer	Impact

Evaluation Objects P,S,B

Table 1, Plan Scheme for the evaluation of a Learning Object

From left to right, the scheme presents in its first column the Learning Objects of the Portal of (Online Interactive Modulate for Teaching Computer Science) which will be evaluated. Next, grouped in three columns until completing

twelve (12), we indicate the general and specific scenarios that will be evaluated in the proposed model for the Evaluation of a Learning Object.

To achieve an effective evaluation, the following classification will be used:

We will evaluate with a (P) Primary, if the Learning Object, when examined, impacts favorably the requirements that concern to the Information Technology and to the formative quality. A (P), Primary, will be marked in the corresponding booth for the specific objective of the particular Learning Object.

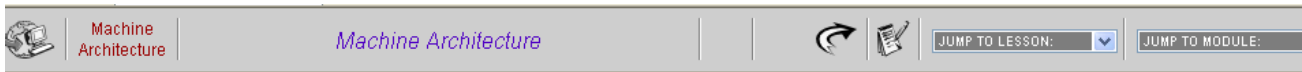
We will evaluate with an (S) Secondary, if the Learning Object, when examined, satisfies in lower or unsatisfactory degree the requirements that concern to the Information Technology and the formative quality. A (S) Secondary, will be marked in the corresponding booth for the specific objective.

We will evaluate with a (B) Blank Space, if the Learning Object, when examined, only satisfies appropriately other criteria that do not correspond to the process that concerns to the Information Technology and the formative quality. A (B), Blank Space, will be marked in the corresponding booth for the specific objective.

Having explained the evaluation scheme we start the experiment taking as object of study the portal [3] .

5. Experimentation with FLOE

For the process of evaluation is used as reference, [3]: Teaching-Learning Innovation Center of the University of Virginia Tech . (See fig. 2.)



Introduction:

The following lessons introduce the topic of machine architecture by explaining data storage in computers, gates and circuits, and the central processing unit. Each lesson includes a set of review questions which test the important concepts from the lesson and provide practice problems. After reading each lesson, you should work the review questions before proceeding to the next lesson. Use the navigation bar at the top of this page to view the lessons and access the review questions. Each lesson page has a link on the navigation bar which will take you to the review questions for that lesson. To begin your study, click at the top of this page.

Lessons:

- I. [Introduction to Machine Architecture](#)
- II. [Data Storage](#)
- III. [Gates](#)
- IV. [Circuits](#)
- V. [The Central Processing Unit](#)
- VI. [Summary](#)

Fig.2. Machine Architecture Instructional Module

Now we start to fill the scheme by listing six Learning Objects that are found in the Portal of the Machine Architecture module of the Teaching-Learning Innovation Center of the University of Virginia Tech [3]See (Table 2, Evaluation of Learning Objects from Portals).

Human Vs Computer, Circuits, and The Central Processing Unit.

The results obtained are: See (Table 1 Evaluation of Learning Objects from Portals):

Positive Quality: The (Learning Objects) evaluated through the model have an evaluation of (P) Primary because in aspects like speed, the interest in the theme is not lost by the scarce or null speed in the connection. In Simplicity and Utility its evaluation is (S) Secondary; because, neither the specifications indicated by [14], [10] are fulfilled; nor the aspects of usability indicated by [24], [26], [32], [31] are considered.

Negative Quality: In Completeness, Accuracy, Validity/Authorization, their evaluation is (P) Primary, because the objects transmit consistency in the management of information without errors, the resources are utilized in a favorable form by the users, and the free access to the contents which is the intention of the Portal's Management[3]; are followed.

Delivery: In the aspect of availability, its evaluation is (P) Primary, because the conditions of Information and Communication Technology are fully satisfied by

Learning Objects	Quality (Positive)			Quality (Negative)			Delivery			Formative Quality			
	Velocity	Simplicity	Utility	Completeness	Accuracy	Authorization	Availability	Confidential	Autonomy	Reaction	Learning	Transfer	Impact
Introduction to Machine Architecture	P	S	P	P	P	P	P	P	B	B	B	B	B
Data Store	P	S	P	P	P	P	P	P	B	B	B	B	B
Gate	P	S	P	P	P	P	P	P	B	B	B	B	B
Human Vs Computer	P	S	P	P	P	P	P	P	B	B	B	B	B
Circuits	P	S	P	P	P	P	P	P	B	B	B	B	B
The Central Processing Unit	P	S	P	P	P	P	P	S	B	B	B	B	B

Table 2, Evaluation of Learning Objects from Portals.

The exam will be carried out to the following objects (Learning Objects): Introduction to Machine Architecture, Data Store, Gate,

corresponding to the needs of counting with information always available. Confidentiality and autonomy are aspects evaluated with (S) Secondary, because the objects are of free use for the users of the Portal which implies that they can be altered [11].

Continuing with the process of evaluation of the (Learning Objects) of the Portal, we analyze them from the perspective of formative quality. The evaluation will be comprised of the development of a questionnaire that will be applied before and after starting the interaction of the participants with the objects. This questionnaire is composed of eleven questions **Kirkpatrick**. To measure the results a simple relation among the number of questions answered and not answered will be used. The relation will be calculated using this equation:

$$EP = \frac{C 2}{P 1} - \frac{C 1}{P 2} \times 100$$

Where:

EP = pedagogical efficacy of the course, seminar, etc. (expressed in %).

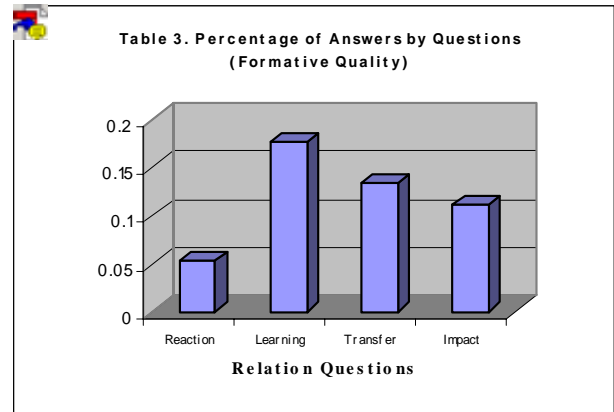
C2 = number of questions answered correctly in the Post Test.

C1 = number of questions answered correctly in the Pre Test.

P2 = total of questions formulated in the Post Test (11 questions).

P1 = total of questions formulated in the Pre Test (11 questions).

To obtain data the questionnaire was applied to the twenty participants of the experiment obtaining the results presented in Table 3 Percentage of Answers by Questions (Formative Quality).



P (Primary % > 80 %)

S (Secondary % between 50 and 80%)

B (Blank Space % < 50%)

In **Reaction (percentage 0.05)**, the evaluation is (B) blank space. The participants showed little interest for these objects, considering them as not interesting, because the contents reflect a good thematic in their development but not quality in the interaction of the interface with the users.

Regarding the **Learning (0.18percentage)**, its evaluation is (B) blank space. The participants showed scarce interest in learning, demonstrating a limited level of knowledge regarding factors like the nonexistence of objects that reinforced the learning and provided feedback of experiences from the Learning Object.

As for **Transfer (percentage 0.13)**, its evaluation is (B) blank space. It was shown that the environment impedes to share and interact among the participants.

The **Impact (percentage 0.11)** that experienced the participants showed lack of training, and a scarce or null capacity to adapt to the new educational paradigms that form part of an unstoppable progressive tendency in modalities of self-instruction and E-Learning. Consequently, its evaluation is (B) blank space.

6. Conclusion and Future Work

At final, it is not enough to know the specifications [10],[14],[19], to improve the design of instructional materials. This proposal of evaluation of Learning Objects permits to recognize the necessary development of sophisticated software tools, that dynamically and automatically manage to diagnose Learning Objects of marked pedagogical quality, didactic, usability, and accessibility in the ICT. The evaluation of the objects permitted to value the quality of the instructional material utilized in the them, in terms of the purposes of their development; and if this, really, improves the instruction, in terms of the abilities of the participant of the environment of learning and consequently the effectiveness in the use of the information and the communication technologies. It also permitted to value the content to be learned, by determining its value in grades of conformity..

On the other hand, the evaluation of the formative quality to which we submitted the learning objects of the portal [3], proved that feedback is required. It is because of it, that not every digital material is a Learning Object effective for learning and knowledge.

Additionally, we found that there is a lack of models to measure the interaction between the participant and the objects, which contemplates aspects like accessibility and usability.

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