Evaluating Learning Objects for E-Learning: Automatic Correction Filters

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Communication and Information Technologies (CITs) are completely changing current educational models. Computers and their communication capabilities through the Internet are becoming more than just a tool, they are now an important means for knowledge management. Learning customized by means of the use of *Web-Based Education Systems* (WBES) is becoming increasingly popular these days. This new way of learning requires new pedagogical paradigms and should necessarily come together with new evaluation mechanisms that replace current presence media. The evaluation process is a very important information means both for the teacher who would keep track of his/her students' progress and the student who, in the new virtual classroom model, needs to get some "signals" on his/her own progress status. In this way, evaluation is also an integral part of the new teaching-learning model in virtual environments. The Automatic Correction Filters (ACFs) introduced in this paper are within the computer technology framework for assisting e-learning teachers.

Keywords: Automatic Correction Filters; Evaluating Learning Objects; WBES

1. Introduction

Web-based Education Systems (WBES) allow for the teacher and students to be at different physical locations. CITs are used to cover such distance. Student-centered education sites are included under this methodology, thus the student is in control of his/her training time and place. Such new education opportunities pose difficulties in learning process evolution follow up and it is widely known that this information is specially interesting both for the teacher and the student. Evaluation processes in distance learning environments become difficult and require a much heavier teacher / student time load than that needed in presence learning environments. On the other hand, in the last few years research related to the Semantic Web, the purpose of which is to give meaning to the different types of information on the Web, has become increasingly important. An important sub-set of that information is represented by *Learning Objects* (LOs), that are digital resources that can be reused in different contexts in order to achieve a particular learning objective. A special type of LOs are *Education Objects*, that are designed, implemented and stored in an adequate way so as to be easily found. This last feature makes them very easy to be reused.

In this paper, we introduce a system for the development of evaluation LOs based on the concept of *Automatic Correction Filters* (*ACF*) This is a software with practical exercises to be solved by the students as input, and classification into two groups as output: those that go beyond minimal requirements and those that should be delivered again according to the correction criteria stated by the teacher. The former are automatically sent by the tool to the teacher so that he/she completes the corresponding manual correction process. The latter are returned to the student with the appropriate messages without teacher intervention. The idea is that the teacher gets involved only when the ACF has approved the

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exercises solved by the students, in order to carry out those correction tasks that cannot be automated, such as the writing style or semantic validity of a concept map or summary, etc. This first development of the tool was conducted by including the use of ACFs in the "English Reading Comprehension Course" offered at this University for the students of all careers with a distance methodology.

2. The Problem of Evaluation in Distance Education

Distance or semi-distance Internet-based teaching and learning processes introduce new variations in learning models applied at different educational levels. Continuous learning, learning to learn, learning communities, self-learning, fostering of the student's genuine interest as part of a social development project and supportive learning, therefore acquire significant relevance in this new teaching-learning framework. Gardner [4] pointed out that technology has revolutionized schools. Everything shows that education in the future shall be organized around the computer, with the advantage of the possibility to design custom-made learning environments, with information and materials adequate for the desires and needs of each individual. Artificial intelligence and virtual reality cast a long shadow on current education. Many of the current tasks shall be performed by programs; many of the things learned today by direct contact or presence shall be acquired in distance or semi-distance virtual interactive environments. The teacher's role shall be revalued according to his or her skills for building the web-quest [3,5] and carrying out tutorships.

Assessment and measurability of the results achieved are of major importance both for the learner and the teacher. *Individualization,* i.e. to deal specifically with the answer of each student and act consequently; and *respect for the learning pace of each individual,* since not all students need to devote the same amount of time to the learning process or simply because they do not arrive at a certain course with the same background knowledge, have implied individual assessment mechanisms. The evaluation model is not a minor issue in distance or semi-distance education. The evaluation concept does not refer only to the final act of sitting for an exam, but to the process that allows both the teacher and the student to detect the contents that are being apprehended during the educational processes involved. You can read more about this in [6,9].

In traditional education, when referring to evaluation activities from the teacher to the students several and particular sources of information that give data on the students' learning process are taken into account: his or her interventions in class, his or her questions, the expression of multiple attitudes, his or her work, exams, etc. [2]. All this information baggage allows the teacher to "guess" on the extent of his or her teaching from the beginning of the course and throughout it and even allows him or her to make certain procedure adjustments during the class. In such sense, "Evaluation becomes a source of knowledge and a place for the creation of educational improvements when organized with continuity. Reflection upon the problems and achievements obtained ... makes the task of discovering relations and supporting decisions much easier" [1] On the other hand, it is also true that the student himself/herself, from his or her activity in class, through the meta-cognitive process, may "perceive" whether he or she is understanding the subject of study, he or she discovers which are the concepts highlighted by the teacher and may interrupt at any time to express his or her reasoning on a certain topic. The achievement educational sites in the Web with mechanisms capable of taking up and process information that is relevant for the continuous evaluation process is a subject for research.

On the other hand, among the advantages of distance education we can highlight the possibility to reach a larger student population, and at the time of evaluation, this turns the teacher/student hour ratio greater than in presence education, something to take into account when the intention is to work according to evaluation patterns of international quality.

3. Automatic Correction Filters

Automatic Correction Filters (ACFs) are mechanisms capable of reducing the teacher/student hour ratio

considerably, not a minor problem when dealing with WBES within the framework of quality standards. They act as sifters, refraining those resolutions that do not meet minimum requirements from going to the manual correction stage and only allowing the answers with chances of being approved to pass through. An *ACF* for application exercise *E*, (ACF_E) is a program with a resolution of *E* as input, that analyzes it and, according to the correction criterion previously entered by the teacher, gives a Boolean-type output. When the output has a true value, the teacher should perform manual corrections to complete the evaluation of the exercise; when the output has a false value, the system that invoked the filter shall inform, both the student and the evaluation module, the unsatisfactory result and the reason for it, without the need of teacher intervention.

An interesting feature in this proposal is the possibility to add ACFs to educational environments of diverse technological levels, that could range from an education portal in technologically more developed distance education opportunities to alternatives in which the teacher-student communication is limited to the use of e-mail or some other magnetic media.

3.1 Use of ACFs as an Evaluation Instrument in E-learning

The motivation was to design a software that would act as a correction aid, that would identify those resolutions that do not meet the minimum requirements in order to go to the manual correction stage, and that would only allow those answers which would have the possibility to be approved to continue in the process. In this way, it is possible to reduce teacher/student hours considerably. In Figure 1 we show the correction process using an ACF. Two work environments can be distinguished: *the teacher node* and *the student node* connected by means of communications technology. The students' solutions are automatically analyzed by the ACF which has the capabilities needed to determine, automatically and without teacher intervention, the following resolutions:

- *Resolutions that go beyond the ACF*, represented in the graph by the arrow that goes from the "ACF evaluation" process to the "Manual evaluation" process, both included in the teacher node. The final mark for the evaluation shall be determined by the teacher based on the filter's information and the consequent manual corrections.
- *Resolutions rejected by the ACF*, are represented in the graph by the arrow that goes from the "ACF correction" process, in the teacher node, to the "Resolve exercise", in the student node; this indicates that the filter shall notify the student the negative result of the evaluation, the messages explaining the nature of the mistakes made, and the suggestions for correcting them.

3.2 Tool for Working with ACFs

A software tool for the exclusive use of the teacher, with capabilities to build ACFs from practical exercises proposed by the chair and to filter the resolutions submitted by the students, was developed. The first development of the tool was motivated by the inclusion of ACFs in the "English Reading Comprehension Course" offered at this University for the students of all careers with a distance methodology. For this reason, at this first stage, exercise types related to the discipline are considered, as shown in 3.2.1. However, this in no way intends to be a limit for enhancing the tool. This tool provides the teacher with an appropriate interface that allows him/her to develop the activities shown in 3.2.2. As design objective, it was intended to keep the greatest flexibility in the solutions, not confining the FCAs to those exercises with only one correct answer. Thus, we provided for the use of a "simple language" with optional list constructors and the connectors *and* and *or*, that would allow to enter different correct answers.

3.2.1 Types of Exercises for ACFs

Each *type of exercise* matches an exercise pattern. The types of exercises are classified into two groups, that in turn define the type of filter that will be associated to them: *fully automatic correction exercises*

and *semi-automatic correction exercises*. For the first group, it is possible to build *absolute filters* with capacities to "correct automatically" without human intervention from the moment when the teacher defines correction parameters. The second set of exercises includes those types of exercises that require a final correction with teacher intervention. In this case, the filter acts as a sifter "discarding" for manual correction those exercises with no chance of passing, for example, those that do not have the minimum key words/phrases requested in a summary.
Among the types of exercises with absolute ACFs, the following ones are considered: main sentence selection, multiple choice, True–False questions, text pattern identification, reference identification, marking of sentences under certain conditions, marking of words in the text with the same connotation (for example, increase, decrease, etc.). The types of exercises with semi-automatic ACFs include: True–False questions that require justification, questions including key words in the answers, re-formulation of noun phrases, summaries including certain key words.

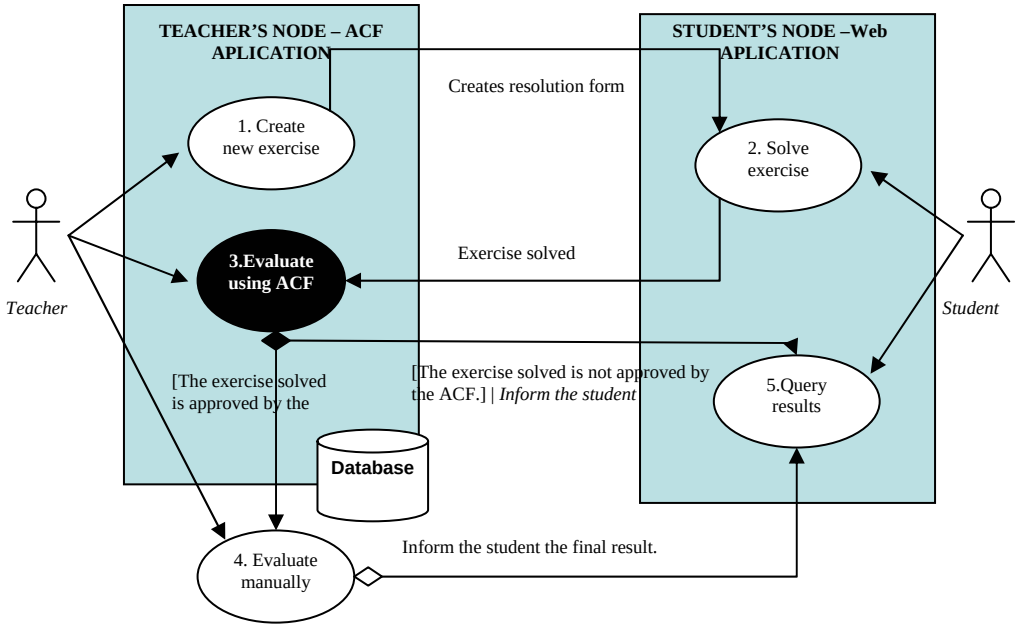

Figure 1 – Evaluation process using automatic correction filters.

3.2.2 Interaction with the Tool

Enter exercise	The teacher chooses the *type of exercise*
	The teacher enters a text. Basic formatting capabilities are available (bold type, italics, *copy* and *paste* options, etc.)
Enter solution	The teacher enters the solution for the exercise proposed. The interface for entering the solution depends on the type of exercise.
	The solution is stored for the system to build the ACF
Define correction criterion	For the filter to perform the automatic or semi-automatic correction, each type of exercise is under a parameter. For example, for a "main sentence identification" exercise type, the teacher may enter the following correction parameters: Sentences that cannot be missing in the solution Total score for the exercise. Score to be obtained for correctly marked sentences. Score to be discounted for incorrectly marked sentences. Score needed to approve the exercise. Message for those students who approve the exercise.

	Message for those students who do not approve the exercise. Should a new solution for the same exercise be delivered or the solution proposed by the teacher is sent to the student?
Audience	The teacher selects the recipients of the exercise from a directory. The directory has group-defining features.
Solution form	Automatically performed by the system: builds the form and sends it by e-mail to the students selected.
	The student enters the solution in the form received and sends it to the teacher node together with his/her personal ID
Create filter	Automatically performed by the system. A special ACF is built, that can be reused for another audience
Correct exercise	This activity is triggered by the teacher when he or she determines that he or she wishes to correct one or more of the exercises received. This includes correcting a particular solution or all the solutions in a directory.
Report	The teacher receives the following information: Answers from the students that passed the filter and that now require a complementary manual correction. List of students that did not pass the filter

In the case of an *absolute decision* ACF, the final correction result is automatically reported to the student and the teacher, if the final correction depends on the manual correction of the teacher.

4. Conclusions

Every day, the offer of Web-based distance education opportunities increases. At the current status of WBES, several research lines based on LOs tending to work in the development of reusable specific components can be observed. A sub-class of such are Evaluating LOs that follow the reuse principle through several applications.

FCAs are a software tool with the capabilities to build and store ACFs and evaluating LOs and are oriented towards assisting the teacher in the evaluation process, specially in distance education environments characterized by a diverse and asynchronous student population evolution-wise. The ACF software is at present in an initial stage and has been designed bearing in mind a future expansion. This project, in addition, has opened new possibilities within the LIDInE for the development of graduation thesis of great interest.

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