

Method for Evaluating the quality of Web-based courses

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Abstract - A methodology for evaluating on collaborative learning processes is proposed. The underlying hypothesis is that three elements affect the quality of online courses: learning quality, content quality, and interaction quality. Evaluation derives from examination of all products that the online learning process yields. The methodology comprises a set of parameters that indicate the quality of online courses and a set of conceptual and technological tools that can be adopted. The paper presents results from the case study wherein the methodology is applied to a Web-based educational course.

Keywords - Web-based education, collaborative learning, evaluation, quality assessment

I. INTRODUCTION

Conventional distance education frees learners from the need to be present in a particular place at a particular time, but it seldom offers the opportunity for collaborative learning. The reason for this may lie either in the lack of necessary technological resources or in underestimation of the importance that the social aspect has in learning. By contrast, co-operation and interaction among participants is fundamental in online courses. What is more, text-based communication conducted in intense message exchange allows the whole collaborative process to be saved and reconstructed. This makes it possible to review design methods and evaluate the course itself. We can observe also the influence of intensity of the dialogue on the learning results of the students.

In this paper we propose a methodology for evaluating online collaborative learning processes; this is based on a holistic approach in that it takes into consideration a wide spectrum of quality-related characteristics. The main aim is to define a quality management system that will make it possible not only to evaluate learners' performance and knowledge acquisition but also (and especially) to determine whether the course in question effectively meets the needs it was designed to satisfy.

The underlying hypothesis is that three elements affect the quality of online courses:

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learning quality, correlated to the products that the participants develop collaboratively during the course; content quality, seen in the exchanges and discussions that participants engage in; and interaction quality, meaning the quality of the communication processes set in motion. So evaluation derives from examination, from the three above-mentioned perspectives, of all the messages and products that the online learning process yields.

Finally, a case study will be described wherein the methodology is applied to an online course dealing with environmental education.

II. ONLINE COURSE MODEL

In online courses three main elements can be identified:

- the virtual community comprising students, tutors, experts, observers and technical staff;
- set of material regarding course organization and running, the technology adopted and the course contents;
- new technology used mainly for performing communication functions, accessing and sharing of information, and collaboration.

We wish to focus on a few aspects related to the communication platform and the functions it performs in an online course, given the close link between it and the evaluation methodology.

The communication platform supporting a collaborative learning environment should permit many-to-many interaction among remote users via e-mail or some conferencing systems. They use asynchronous (or deferred) communication, sometimes incorporating synchronous functions such as chatting or videoconferencing.

Computer conferencing environments differ from traditional uses of e-mail in that they are closed and feature controlled access.

The computer conferencing system provides the following interaction modes:

- information exchange, knowledge sharing, group design and development of products;
- co-decision making and negotiation;
- familiarization activities;
- access to external sources;
- access to multimedia learning material.

Module structure

Online collaborative activities call for careful planning, together with timely co-ordination and synchronization efforts on the part of tutors, who play the critical role of stimulating, moderating and mediating. Learning modules are divided into five main phases.

1. *Tutors' stimulus messages*
2. *Local group activities*
3. *Group reply messages*
4. *Analysis and call for discussion*
5. *Discussion among the remote groups*

III. A METHODOLOGY FOR EVALUATING THE QUALITY OF WEB-BASED LEARNING PROCESSES

In this section we will seek to identify what to evaluate and how to evaluate an online course. Finally, we will outline the

chief aspects regarding instrumentation and operating procedure.

What is to be evaluated is the quality of online courses. So, we should first define what is meant by quality in learning processes in general and quality in online courses in particular.

Online learning is chiefly based on collaborative learning strategies; a number of researchers have sought to define what collaborative learning actually means. A broad definition of collaborative learning might be individuals' acquisition of knowledge, skills or behavior as a result of group interaction, or to put it simply, individual learning resulting from group processes see (2) and (3).

Processes of this kind are primarily linked to theories that regard individual learning as a result of social interaction (4). We shall therefore correlate the quality of online courses to both the learning gained by the individual participants and to the interaction that has taken place within the group involved. In online courses, interaction largely centers on a certain knowledge domain. The quality of that interaction will depend on two main elements: the quality of the dialogue that takes place within the group and the quality of the contents dealt with in that dialogue.

Hence, quality is not an absolute value, but is to be considered in relation to the evaluator's interpretation of the context based on predefined learning objectives.

On this basis, our methodology correlates quality in online courses to three elements, that can be thought of as independent components in a three-dimensional quality space Fig. 1:

1. learning gained by the individual participants;
2. interaction, that will be evaluated in relation to the context in which that interaction occurs and on the basis of predefined aims;
3. course contents: the contents of an online course, partly provided to the participants and partly developed by them, should also be evaluated in terms of the context of the dialogue between participants.

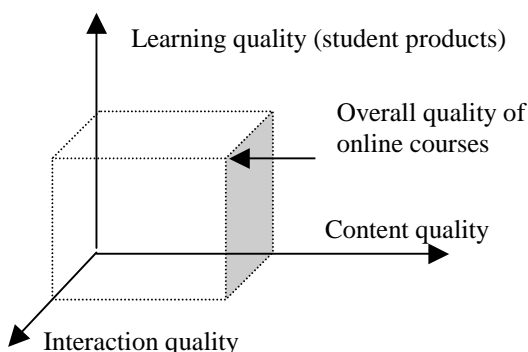


Fig. 1. Overall quality of online courses

The key idea in proposed methodology is to grade each message and each product according to predefined values and attributes (quality parameters). Online courses are divided into a number of conferences, which are composed of chains of messages known as threads, which in turn are made up of individual messages. Accordingly, overall course quality is

measured by tallying the quality of the conferences. Conference quality is calculated on the basis of thread quality, which in turn sums up message quality. It is worth noting that all course products, whether they be reports or messages, contribute to determine course quality.

The quality parameters of a message are its:

- Contextual congruency?
- Formal congruency: e.g. does a reply incorporate the relevant parts of the original message?
- Appropriateness of codes.
- Building new knowledge: the educational and cognitive contribution within the context of course objectives.
- Contribution to interaction: does the message prompt discussion and does it keep it alive?
- Correctness of contents: are the contents of message in line with the activities the tutors set?
- Timeliness: are participants promptly responding to tutors' proposals and reacting to the messages of the other members of the community?

IV. INSTRUMENTAL AND OPERATIONAL ASPECTS

In this section we shall describe the tools (both conceptual and technological) and the phases comprising the evaluation methodology. This model is the framework for the database that is used for online course evaluation.

The main elements in the database are:

- community member, which may be a single student (individual student), a group or a tutor.
- conference, which identifies the individual course module.
- message, which comprises a number of attributes:
 - the function performed (persuasive, informative, metalinguistic, etc.);
 - the subject of the contents (CMC system, course-related topics, etc.);
 - the thread that the message belongs to; it should be noted that, in the extreme case, a thread may be no more than one message long, where this message has received no reply or comment;
 - the type: this is the broadest category, and is primarily based on content;
 - the quality parameters described earlier.
- documents.

This last category is distinct from the preceding one in that documents contain material which is not necessarily the fruit of course communication and which has a purpose beyond that context. Examples of such documents include student products, reference material that the tutors or experts have made available in digital form, files in formats which are incompatible with that of messages (graphics, electronic spreadsheets, databases, etc).

One interesting aspect here is that document sharing can stimulate community discussion, and this is even truer of collaborative document development: the tutors can use a provocative article to stimulate debate; draft products may require repeated revision and refinement before agreement can be reached on a final version.

The database is compiled semi-automatically. Objective data such as the attributes' sender, receiver and date related to each message are imported from the CMC server. Conversely,

subjective data like message type, function and quality are determined by the evaluator on the basis of the discussion context, and are stored in the database using an appropriate input form. Quantitative measurement values derive from weighted averages, whereby each element that helps determine the average is duly weighted. By setting the weight of the various parameters, the evaluator can tune the evaluation process in accordance with each conference's objectives. For example, the code correctness parameter may be attributed greater importance in a topic-based conference, or lesser importance in a conference for collecting reference material.

Conference interaction quality in turn depends on thread quality, but also on factors like thread length (distinguishing between messages sent by students or tutors), their temporal duration, and the prevalent type of interaction.

Similarly, thread quality is derived by summing the quality levels for each constituent message. The final element related to the quality of overall course interaction is message quality, which results from the values given to each of the quality parameters.

Interaction quality is only one of the three components comprising course quality. Learning quality (related to student products) is expressed by two quality parameters applied to each conference: formal congruency and content congruency.

Clearly, the usefulness of such a system is not limited to the calculation of a single numerical value expressing the degree of overall course quality. It is often fruitful to compare partial quality measurements, such as those of two topic-based conferences, or the same conference in two different editions of the same course.

V. A CASE STUDY IN THE APPLICATION OF THE PROPOSED METHODOLOGY

One of the primary aims of this work has been to test the validity of the above-described evaluation methodology. This has been done by applying the elements that emerged in the theoretical phase to an actual online course.

The testing has involved a study of messages exchanged through the Course Support System – WebCT, by the students during the distance learning course conducted entirely online. The theme of the course was “Information and Communication Technologies in Education”.

As already stated, our methodological approach is based on detailed analysis of every single message, considered as the basic component of the online interaction process. For each conference, an outside observer attributes a value (from 1 to 10) to the quality indicators on the basis of the conference's objectives. Once data input had been completed, we proceeded to formulate database queries. The first step was to extrapolate the elements comprising overall quality of an online course, seen as a function of content quality, interaction/communication quality and learning quality. The description below shows the main logical steps that led to defining and obtaining the overall quality value of the course in question.

A. Query: interaction/communication quality

These data were obtained by applying the analysis criteria illustrated earlier and by careful weighting not only of the quality parameters applied to individual messages but also of the conferences themselves. It is possible to endow each conference with a weight vector, i.e. a value expressing the relative importance of the topic dealt with in that conference, in terms of the overall objective of the online course. The interaction /communication quality peaks in the middle sections of the course and in the laboratory conference (the latter can be explained by the intense message exchange arising from the numerous technical problems experienced during the course).

B. Query: content quality

Values for content quality were obtained from the weighted sum of the quality parameters content correctness and new knowledge. Content quality appears evenly distributed across the various discussion areas but peaks in the Library, where documents related to the course topic are stored.

C. Query: learning (product) quality

This value was obtained through analysis of the students' products. As with content quality, it corresponds to the weighted sum of two quality parameters, in this case formal congruence and content correctness. These are related to the files attached to messages and to messages that the evaluator considers as student products. The quality levels for products peak in the last module of the course.

D. Query: overall quality

The overall quality level of the course derives from the relationships between the levels of interaction quality, content quality and learning (product) quality. So we can define the course overall quality level as a point in a three-dimensional space, where the three axes are represented by the three quality measurements cited above.

VI. COMPARISON WITH CONVENTIONAL EVALUATION METHODS

Besides the evaluation carried out using our methodology, the course was also evaluated in a more traditional manner. Let us compare the findings. The outcome of the online questionnaire is based on responses from 16 participants (out of a total of 40 people, divided into eight groups). The respondents expressed satisfaction with the course, although complained about the amount of time it demanded of them. They were also happy about the communication/interaction that took place with tutors, experts and other participants. In addition, most of the respondents were satisfied with the role played by the tutors, though it was felt that they were overactive (9 respondents out of 16). Intense tutor activity was borne out in our findings as well, comparing the participation levels of all learning community members. Tutor co-operation, feedback and support was not the only positive finding from the questionnaire responses. The teaching approach adopted was also judged to have helped participants

as they progressed through the course. They were happy with the CMC system, both in terms of the user-friendliness of the interface and the innovative learning style. Overall we can conclude that the findings obtained from the online questionnaire confirm the results of our global quality evaluation, namely that the course was a success.

Another important finding from the observation was the influence of intensity of the dialogue on the learning results of the students. Fig.2 shoes the results.

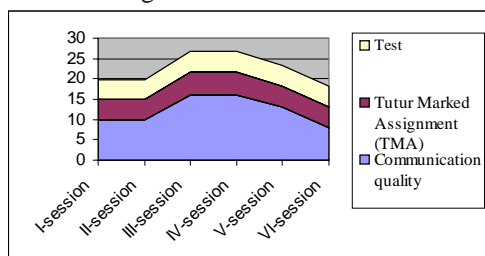


Fig.2. Influence of the dialogue on the learning results of the students.

VII. CONCLUSIONS

This article has presented an approach for evaluating online collaborative learning processes, one based on quantitative measurement of quality parameters related to three aspects of the course: the products developed by the participants, the contents provided and produced, and the interaction that took place. The methodology proposed draws on data management techniques that make it possible to compare the quality levels of different sections of the course, different student groups, and different editions of the same course. The testing carried out so far has highlighted the effectiveness of the approach, which is confirmed by comparison with the findings gained using conventional evaluation methods.

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