Computer Supported Authoring of Questionnaires

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Abstract — An important concern in web-based learning systems is the task of designing and preparing student assessment. After reviewing some computer tools for assessment authoring, we observed that many of them are not flexible enough due to the following aspects: ease of integration to a learning system and the possibility to implement author-defined types of questionnaires. We posed the hypothesis that a questionnaire-authoring tool, fostered by an XML defined language, would provide the desired flexibility while helping to investigate a reasonable generic model for questionnaires. As a preliminary result, we implemented an authoring tool that was integrated to a web-based learning system, named CALM. Neither teacher nor students need to know advanced computer concepts to use the tool.

Index Terms — Computer-Managed Instruction, Authoring of Questionnaires,

I. INTRODUCTION

The design and authoring of assessment is an issue faced in many web-based learning systems. Several approaches are available, but most consist of solutions tightly coupled to the respective learning systems. Such limitation is a serious difficulty while implementing and testing different assessment approaches, as for instance, some qualitative assessment based on augmented teacher-student interaction. A complementary issue is the lack of a standard for modeling questionnaires.

In this paper, we pose the hypothesis that a questionnaire-authoring component, fostered by an XML (eXtended Markup Language) [1] defined language, would provide the desired flexibility while helping to investigate a reasonable generic model for questionnaires.

The strategy comprised the design and implementation of a computer tool for the authoring of questionnaires, the QuestCALM — Quest from Questionnaire in the CALM system (Computer-Aided Learning Material [2]). The CALM system is a platform of software components to deploy web-based learning systems [3]. The current implementation of CALM comprises an intelligent tutoring system [3] to recommend lessons and some interactive tools, such as a web page annotation mechanism (group and personal), a software testing component, an applet configuration interface, and a chat. The pedagogical orientation adopted was inspired by the Goal Based Scenario approach [4].

The next section outlines the major features found on tools for questionnaires authoring. Section III describes advantages of QuestCALM over these tools. Section IV shows the graphical interface of QuestCALM. Section V details some benefits of integrating QuestCALM with CALM. Finally, Section VI presents some conclusions.

II. TOOLS FOR QUESTIONNAIRES AUTHORING

The qform tool [5] creates and automatically grades multiple-choice and true-or-false self-testing quizzes. The resulting document may be available over the WWW (World Wide Web). Authors do not need to know HTML to use this tool.

HotPotatoes [6] is a suite of five authoring tools for creating multiple-choice, gap-fill, text-entry, jumbled sentence, and crossword exercises. These exercises are fully interactive and compatible with all languages based on the roman character set (including accented characters). As in qform, HotPotatoes tools are designed for non-programmers, and the produced exercises may be available over the WWW.

QuestBuilder [7] allows the authoring of the following types of questions: Open, matching, multiple-choice, and true-or-false. The correct answer is included in test-based questions; therefore, answers can be automatically evaluated when a student finishes a questionnaire. If open questions are used, the answer is mailed to the instructor whose electronic address was included in the question.

QuizTest [8] allows a student to answer online a multiple-choice or true-or-false quiz. At the end of the quiz, it is possible to present the following information: Answers for the questions answered incorrectly, the percentage score, previous high scores on the quiz, and a grading scale. QuizTest also emails detailed results to the instructor, along with the date and time of the solved quiz.

WebCourse [9] supports the following types of questions: True-or-false, multiple-choice, free answer, and gap-fill.

WebCT [10] is one of the most complete tools for developing courses over the WWW, providing the instructor with many statistic data such as course offerings and student individual progress. WebCT uses multiple-choice, true-or-false, and open questions.

III. FEATURES OF QUESTCALM

QuestCALM enables not only the authoring of multiple-choice, open, and true-or-false questions, but also questions based on external tools. For example, this last type of question may facilitate the assessment in a music course, providing that a special-purpose application be dispatched to show a musical notation. The diversity of question formats supported by QuestCALM was stipulated as a first attempt towards qualitative assessment within a web-based learning system.

Unlike previously reviewed tools, QuestCALM is easily presented in English or in Portuguese languages. Other languages may also be added without changing the source

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code. As in all reviewed tools, it is unnecessary to know advanced computer concepts in order to create a questionnaire.

All question categories within QuestCALM share some attributes such as statement, weight, and a hint for resolution. The hint may be either a text or a link to a WWW document.

Questions were implemented with an XML-based language. XML is a valuable resource not explored by the other tools. It allows incorporation of other types of questions. New attributes may be incorporated to already existing questions or to a specified set of questions.

IV. A PRACTICAL EXAMPLE

When QuestCALM is activated, the window showed in Fig. 1 is displayed. The Questionnaire menu has the following options: New, Open, Save, and Save as... The Edit menu enables to change and remove an existing question, while the four buttons at the menu bottom are used to create a question.

Fig. 1. The main window of QuestCALM

Questions may be configured using the QuestCALM interface. Fig. 2 shows how to specify attributes of an open question in QuestCALM.

Fig. 2. Specification of an open question

Fig. 3 exhibits the configuration window used to create a true-or-false question.

Fig. 4 illustrates how a teacher may incorporate a table into the student’s answer by specifying the full filename of an editor.

Fig. 5 demonstrates the first window of a multiple-choice question.

Fig. 6. Edition of one option of a multiple choice question

Questions constructed so far are presented in the main window of QuestCALM (Fig. 7).
V. INTEGRATION OF QUESTCALM WITH CALM

The integration of new tools to the CALM platform benefits a lot from the component-based architecture adopted. Design and development of component-based educational technology is a current thread of research [11] and discussion [12]. The IEEE Learning Standards Technology Committee [3] defines the concept of "learning object", which, for our design purposes fits well the term component. Here follows the definition for learning object: "Any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning".

Since the CALM platform required and enabled QuestCALM to be developed as an independent software component, a very refined function and interface interoperability was accomplished. Visually, a specific button in the CALM graphic interface gives the access to the QuestCALM tool. Logically, the QuestCALM tool exchanges events and data with other components of the platform, while obeying to a pre-defined framework of integration.

We advocate that component-based construction of web-based learning system promotes the exchange of reusable solutions among developers and researchers. From our experience, other advantages relate to better design, faster development, and ease of integration.

VI. CONCLUSIONS

QuestCALM was our first step in investigating an important facet in web-based learning systems, the assessment design. The tool is appropriate, exactly due to its fully integration to an web-based learning system. Another point is its flexibility of not restricting assessment to a fixed set of formats, since other types of questions may be created. Furthermore, the language option for its menus and windows is easily configurable by a text file for each new language.

Our next efforts are to develop a complete learning scenario for qualitative assessment. The general approach will be to support the indispensable interaction between teacher and student by means of web page annotation mechanism, which is already available with the CALM platform. Student and teacher communicate understandings, corrections and arguments via annotations at conflicting points of an answer. Such process lasts until they feel satisfied with the final answer. In this way, we expect to give a further step towards qualitative assessment in web-based learning system.

REFERENCES