iQuiz: integrated assessment environment to improve Moodle Quiz

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Abstract— Moodle is a well-known open source system to support teaching and learning through the web. It provides Quiz, a tool for learning assessment, which is also adopted by a large community along the world. Another tool that allows automatic assessment within Moodle is the iAssign package. iAssign provides means for integrating interactive Learning Modules (iLM) to Moodle, empowering it with interactive intense activities concerning specific issues implemented in iLM. However, such tools present some limitations that prevent their users to take more benefit of the question types and iLM such as (i) authoring is not a simple task; (ii) iAssign integrates iLM to Moodle without incorporating Moodle questionnaires; (iii) Quiz database for questions and questionnaires is not integrated to a repository with search and retrieving tools; (iv) in the current version of Moodle, Quiz didn’t allows the incorporation or exportation of assessment content that follows the IMS-QTI 2.1 (Question and Test Interoperability) specification. In this paper we address such limitations proposing a generic model and its implementation for the Moodle system.

Keywords— Moodle; Quiz; iAssign, assessment; repository; IMS-QTI 2.1

I. INTRODUCTION

The use of systems to support learning through the web has gained increasing attention in the last decades [1][2][3], mostly with the use of Learning Management Systems (LMS). Among the large family of available LMS, an open source solution is Moodle [2]. Since its first version, Moodle evolved considerably and it presents several functionalities to facilitate the processes of teaching and learning, as well as to manage activities related to them. We can cite some of the more important functionalities as the ones associated with the authoring, interactivity, and automatic assessment of instructional content [4][5][6][7]. In fact, almost a decade ago we could find in the literature some research directions related to increase the types of ways of interacting and assessing multimedia instructional content, including automatic assessment resources [4].

These functionalities allow, while logged in the system, the development of instructional content and the assessment of students’ performance while interacting with such content during the learning process. Nevertheless, such content can be stored in instructional repositories and reused whenever needed. Moreover, authoring and assessment are important issues for any LMS. Quiz is the Moodle module associated with authoring and assessment [8]. By using Quiz, one can build questionnaires (quizzes) with automatic assessment resources. The quizzes may adopt several types of questions, including multiple choice, true-false, and short answer. Also, Quiz questions can be stored in a “question bank” to be further reused. Although Quiz provides features to the building of new types of questions, some issues may cause limitation on using them [9]. In addition, this prevents importing or building interactive intense instructional content [7], as the ones provided by iAssign [5] and questions that follow the IMS-QTI 2.1 specification [10].

In this paper we present an integrated model to provide means of authoring, automatic assessing and storing instructional content. Such model is implemented as a Moodle plugin called iQuiz (interactive Quizzes in the Internet). In section II we describe the model, and in section III we present iQuiz. Some related work is given in section IV and, finally, section V outline our conclusions and suggests future work.

II. AN INTEGRATED MODEL FOR ASSESSMENT WITHIN LMS

Our proposal for improving the scenario described along the introduction is an integrated model that adopts a component-based structure to provide a solution for combining authoring activities with automatic assessment and storage. The model is composed of three main components: authoring, interoperability and repository (see Fig.1).

The authoring component is responsible for providing means to create instructional content to be used during the learning process mediated by the LMS. Such component must provide support for creating interactive intense instructional content with automatic assessing and exporting the created content to instructional format standards. This component is the core of the proposed model since it has its main responsibilities.

Instructional standards are provided by the interoperability component that feeds both, the authoring and the repository component. The compliance with instructional standards must

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be transparent to the LMS, since this component didn’t communicate with it.

The repository is responsible for storing instructional content, as well as providing tools for searching and retrieving such content, that must follow instructional format standards to provide interoperability among distributed repositories along the world.

![Fig. 1 The model structure](image)

An important feature of the iRepository is its integration with LMS internal data. This means that an item in the repository could be associated with its usage by the end user, usually the students. This feature is important to support future work leading to IRT (Item Response Theory) [11] or some data mine to extract information about the item related to the student performance [12].

In order to validate the proposed model, an implementation of it to the Moodle system was designed.

### III. iQUIZ: IMPLEMENTING THE PROPOSED MODEL

The model implementation adopts some Moodle packages to serve as basis for the authoring component; a question and test assessment specification (IMS-QTI 2.1) to deal with interoperability issues and a repository.

The Moodle packages considered are: Module Quiz; the iDCR repository and the iAssign Moodle package. Quiz was aforementioned in introduction and will be further explained. iDCR (Interactive Digital Content Repository) is a proof of concept of a repository that is integrated to Moodle [13]. iAssign is a Moodle free package that allows incorporating Interactive Learning Modules (iLM) [14], and it is available at http://www.matematica.br/ia. Also, iLM provides means for integrating interactive learning tools to any LMS. Usually an iLM is an applet Java.

iAssign is a Moodle package that provides means for authoring interactive intense instructional content since it integrates iLM to Moodle. Whenever an iLM allows automatic assessment, the same is true for the derived interactive intense instructional content. Therefore, iQuiz’s underlying idea is to incorporate a new type of question to the Moodle Quiz using the iLM in a similar way iAssign does it.

The IMS-QTI is acronym to Question and Test Interoperability, a specification to promote interoperability between LMS when considering tests [15]. It was initiated in 1999 and is under the responsibility of the IMS Global Learning Consortium (http://www.imsglobal.org/qti.html). The IMS-QTI 2.1 specification can express interactive and parameterized assignment, meaning that any student can get a different instance of the exercise. Additionally, with IMS-QTI 2.1 it is possible to express constraints between interdependent parameters to assure that any instance of the exercise has the same level of difficulty [10].

The last component considered in iQuiz is the repository, an essential tool to easy share any educational content (or Learning Object - LO) [16]. The iQuiz repository component is iRepository, an extension of the iDCR.

Therefore, the authoring component of the model is an extension of Moodle Quiz in order to provide questions of iLM type, which means questions (ideally) with interactivity intense with automatic assessment resources, and interoperable resources. The extension also will allow other types of questions as the ones based in constraints with IMS-QTI 2.1 (e.g. advanced Math [16]). Also, a new user interface will be provided to deal with limitations described in [9]. It is represented by the iQuiz Question Type in Fig. 2.

![Fig. 2 iQuiz big picture](image)

The interoperability component provides the usage of questions under the specification IMS-QTI 2.1. It feeds the authoring component with information to import and export the questions to IMS-QTI 2.1 specification, through Question Type Component of Moodle (it is represented in component iQuiz of Fig. 2). It also allows the description of questions types that follow Moodle standards, as well as new question types such as iLM and Advanced Math. In addition, it is used by the iRepository to maintain conformance with instructional content standards for content description and assessment.

Fig 2 presents the big picture of the model implementation. The iQuiz core could have several new types of question. In particular, it has the iLM type of question and one type of questions from IMS-QTI 2.1.
IV. RELATED WORK

In [20] it is reported the combined use of Moodle Quiz with the WIRIS quizzes, since they are already integrated. WIRIS quizzes (CASs) are developed to enhance the computer-based assessment in mathematics and science when integrated to an LMS. It offers: (i) formula edition at authoring time and formula visualization at presentation time; (ii) WYSIWYG input of formulas in the student answers of an open question; and (iii) formulas are input in the common mathematical notation [21]. Nevertheless, it didn’t provide interactive intense content within questions, since it is an algebraic (symbolic) system. Therefore, questions description looks like in a book and interactivity is just the immediate feedback provided by the automatic assessment resources.

STACK is another open-source system to assess elementary algebra [22], with emphasis on formative assessment. It provides a question type for Moodle Quiz and the STACK questions are the ones whose answers are mathematical expressions. It adopts a computer algebra system to evaluate whenever an answer is right. iQuiz will provide more than one Moodle question type, since each iLM [6][17][18] will define one question type. There isn’t any citation about the importation or exportation of STACK question types to IMS-QTI 2.1 as will be for iQuiz.

V. CONCLUSION AND FUTURE WORK

In this paper we presented a model for creating and integrating educational assessment content and iQuiz, its implementation as an integrated module to Moodle, one of the most known and used LMS within the world.

iQuiz extends the Moodle module Quiz by incorporating new question types, specially the one which provides interactive intense questions generated using iLM. Also, it provides interoperability resources to encourage assessment content sharing and reuse. Nevertheless, iQuiz is integrated with a repository that provides instructional content storing and retrieving in a granular fashion, meaning that questions may be searched and retrieved in isolation or in group, as a full questionnaire.

References