E-Assessment System for Young Learners (EASY)

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While more e-learning systems are emerging, for follow-up and revision purposes there exists little on evaluating the learning in these systems. This paper presents a framework for an Electronic Assessment System for Young learners (EASY), which not only generates the results at the end of the assessment but also provides revision and a follow-up stage by making use of the records of the answers. The proposed e-assessment framework uses mainly AI devices (neural network, decision tree) and inference engines (rule base, forward and backward chaining), which allow appropriate questions to be created and also keep track of students’ learning/development. The specific methods used are: 1) clustering techniques, which enable the system to group the characteristics of the objects; 2) forward chaining which on the basis of the answers predicts what the learners are thinking and 3) backward chaining, which checks the answers and uses them for revision. The knowledge database thus derived provides material for the e-assessment.

1. Introduction

The construction of e-learning systems for young learners has specific requirements, which are different from those applied to e-learning systems for adults. The same holds for electronic assessment, which is also a growing area of research; little has so far been investigated with regard to the e-assessment of young learners’ learning outcomes.

Electronic assessment (e-assessment) is an alternative form of assessment, which can be used to evaluate students’ learning development. According to JISC, e-assessment is defined as follows:

The end-to-end electronic assessment processes where ICT is used for the presentation of assessment activity and the recording of responses. This includes the end-to-end assessment process from the perspective of learners, tutors, learning establishments, awarding bodies and regulators, and the general public. (JISC, 2006)

Assessment in this domain can be related to recognition and motivation (formative assessment), recording the learners’ achievements (summative assessment), helping students to understand their development needs (diagnostic assessment), defining levels of achievement (standard setting), and enabling employers and teachers to recognize what young people have achieved (differentiation and selection) (Duckett and Jones, 2006; Jones, 2005). Theoretically, an e-assessment should be uninfluenced by the way in which the learning has been carried out, i.e. whether through face to face learning, blended learning or e-learning.

The process for developing e-assessment components with multimedia elements comprises the following stages (developed from Barrett, 2002):

- Investigating the needs of the potential audience
- Planning for and designing the e-assessment components
- Developing the necessary parts and reusing/re-organizing existing parts for the presentation
- Recording and implementing the materials
- Evaluating the system

In the first phase, the investigation concentrates on the potential users of the e-assessment system, which identifies the users and the needs of different target groups. This leads to the design phase, in which basic elements of the system are designed and organized. This phase includes a planning component, comprising a search for components which can be reused in the system and need not be designed from scratch. In the development phase, the necessary components are gathered and constructed, for example, organized into a sequence. The record and implementation phase leads to the actual materials used for the system. Here the materials are produced, by, for instance, recording audio and video sequences and editing the necessary textual passages. These phases are used not only for e-learning applications but also for almost all the other areas in which multimedia play an important role.

As computer technology evolves, more and more
sophisticated approaches can be adopted to develop a user interface. In learning environments which use conversation as a means of assessment, the user interface should be based on learning theory, in particular, learning through conversations (Harri-Augstein and Thomas, 1991; Brockbank and McGill, 1998). For young learners the types of question are related to the learning of a particular subject domain, such as objects expressed in their native language. Since we do not expect higher level thinking and critical and reflective questioning, the types of questions are more limited than they would be in an advanced conversation, where Why and How questions would be asked, not only on the topic of the assessment but also about the previous learning phase (Harri-Augstein and Thomas, 1991).

In this paper, we propose a framework for the e-assessment for young learners (EASY). We start this by examining e-assessment for young learners, e-learning and e-assessment in section 2. Section 3 provides an overview of the system framework. In the last section some conclusions and further development of the work are discussed.

2. Young Learners, E-learning and E-assessment

As has been mentioned, while the available e-learning programmes are mostly for higher education, so far those for young learners are still being developed. Available applications of e-learning in teaching young learners can be seen in first language education (e.g. remote education by e-learning), mostly concerned with English as a foreign/second language (EFL/ESL).

In related areas of research, i.e. computer assisted language learning (CALL), its effectiveness in teaching vocabulary has been reported (e.g., Takefuta 1999; Chuiyo and Nishigaki 2005) on the basis of the importance of vocabulary knowledge in understanding any language (e.g., Wilkins 1972, Nation 1990; 2001, McCarthy 1990, Laufer 1997). In the EFL environment, above all, language learning is generally more challenging, because of the scarcity of input. Moreover there is little in the way of L2 (second language) mental lexicons, which “[consist] of a core vocabulary of known words”, readily available to EFL learners, least of all at the early stage of learning, when they tend to rely heavily on their L1 (first language) knowledge (Singleton, 1999). For instance, when learners are learning the names of objects (such as fruits and vegetables), it is hard for them to conceptualize the meaning and characteristics if they have not already encountered the objects in their L1. Moreover, motivation is in general one of the important factors to consider in the teaching of young learners, since they tend to be less intrinsically driven than adult learners.

In the case of teaching EFL to young learners, through e-learning materials, Chuiyo and Nishigaki (2005) identify the need to teach young learners everyday vocabulary via an e-learning course. Their structure for the proposed learning process has three steps: 1) presentation; 2) practice; and 3) performance. But despite the presence of such systems, which are targeted at young learners, little attention has been given to evaluating and checking the learners’ understanding or identifying the areas needing revision. There seems to be a tendency to avoid the concept of ‘assessing’ learners, for such reasons as that the result, if negative, could be discouraging. In the case of evaluating young learners in general, the formative and summative distinction is often overlooked (Rea-Dickins and Rixon 1997). However, it is important to consider ways of checking and evaluating learners’ understanding in any pedagogy. Moreover, it enables educators to monitor the learners’ learning as well as the effectiveness of the techniques and approaches, for in the end it provides material for the follow-up and revision phases. The points raised above (i.e. the development of the understanding of lexical concept, motivation and the learning environment) should be fed into the design of the interface for the assessment, which will be discussed in the next section.

3. System Framework

Nowadays, user interfaces can be designed and implemented with a wealth of technical opportunities, which may lead to important points being overshadowed. For young learners, the user interface must be entertaining and more attractive than that for adult learners, without distracting the young users from the intended conversation (Aust and Isaacson, 2005).

The software development of the user interface in this project has been carried out using rapid prototyping (for an overview of the various rapid prototyping paradigms for the implementation of user interfaces, see Hardtke, 2001). The system is designed according to the needs of young learners, as outlined in the previous section. Fig. 1 shows how the e-assessment component is embedded in the instructional process and which paths a learner can take, depending on the assessment results. In EASY, the assessment of learning development is independent of the type of learning phase. Students from classroom instruction can be assessed, as can students from blended learning and e-courses.
The system design of EASY has to take into account several considerations, outlined below:

- Reliability of the system
- Types of assessment needed
- Generating questions which are appropriate for young learners to understand
- Matching the assessment procedure with individual learning styles
- Information security

The framework is developed using Artificial Intelligence and an inference engine with rule-based forward and backward chaining. This framework can work as follows:

- Manage knowledge about things/objects, e.g. fruit, animals
- Provide yes/no questions for learners
- Search and ask reasonable questions and lead them in the right direction
- Display questions which learners have answered already in the session
- Predict what thing/object the learner is thinking of
- Suggest answers for each question if learners are in need
- Assess learners’ style of learning, e.g. recognition, understanding, analysis
- Give marks to student after assessment
- Add/Edit/Delete data of objects, pictures, multimedia and knowledge related to the learning material.

To implement EASY the following methods are used (Fig. 2):

- A clustering technique is used to group objects or things which have similar or the same characteristics, e.g. shape, taste, smell or colour.
- Inference engine tools: forward chaining (data driven) is used for finding what thing or object the user is thinking of when using the system. The tool considers and examines all the information and data from the answers provided by the learners, e.g., after learners have chosen what things/objects they want to learn and revise, such as fruit. Then the system asks learners about the shape, taste, smell, etc. of the fruit. The learners are required to provide answers (yes or no), so that the system can be guided by these previous learner answers, in order to provide further appropriate questions to follow. This process, at the same time, predicts the answer which the learners have in mind.
- Backward chaining is used to recheck and trace the answers to the questions, e.g., if the answer is ‘an elephant’ (animal section) then the system rechecks all the questions and the answers which the learners have provided, for instance, as answering yes for 4 legs, big size, has trunk and tusks, etc. From this, the learners can get full marks if they provide all the correct answers to the questions generated by the system; and fewer marks if they have answered incorrectly. There are no more than 20 questions in each assessment.

4. Conclusion and Further Work

This research has led to a structure for an E-Assessment System for Young learners (EASY), which comprises an appropriate multimedia-enhanced user interface and a neural network for intelligent questioning and answering. The decision tree is used to arrange the questions and answers automatically.

The system has the advantage of providing summative assessments, which are related to the learning of concepts of objects in the native or in a foreign language. The system can be used as a tool for guided assessment and also for self-assessment. Furthermore, EASY can be usefully set up as a distance assessment system; for instance, through the implementation of a web-based user interface.
There is an ongoing project of further development of EASY (Snae, et al, forthcoming), which enables learners to ask questions. The advanced version of this framework further uses a word-matching algorithm which is used to match keywords in the knowledge base about the characteristics of an object with words from learners’ questions. The detail of the matching algorithm is described in Snae (2007); Snae and Brueckner (2007).

Another area of further work is the recommendation of further studies and the outline of an individual study plan for the student who has been assessed, incorporating the assessment session into an e-portfolio of learning. This is an “electronically-based portfolio, i.e. a file store and information management system which is modeled on the working method used for paper portfolios, but which takes advantage of the capabilities of ICT, notably allowing earners to store digital artefacts and streamlining the process of review and moderation for learners, tutors, moderators and verifiers” (JISC, 2006).

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References