A Learner-Centered Multimedia-Enhanced System with Online Assessment for Young Learners

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Abstract
In our traditional school system many teachers favor study materials that are teacher-centered, since they support the paradigm of the current education system in a natural way. Research has shown that this approach usually does not lead to the best learning outcomes among the students. Forcing students to think about the material, to make choices and to respond (labeled as active learning) have mostly better results than just letting them read and listen. In this paper we describe the processing and the results of a design and create project aimed at implementing an extensible modular multimedia-enhanced learning environment for young learners with an online assessment component.

The objective of the system is to generate learning materials and students' learning development assessment, which can be represented by quizzes and tests. The system in this paper is based in part on an earlier version of an E-learning Assessment System for Young learners (EASY) and a Distance Object Learning and Evaluation framework (DOLE). Moreover, we present the general system framework together with the user interface, which is currently in Thai language.

1 Introduction
Based on the classical view on interactivity we can say that an interactive learning environment is an educational software that accepts and responds to input from students, for example, data or commands. To be effective in terms of student engagement the interactive learning environment should also provide interactivity on the presentation layer consisting of the learning materials, i.e. interactivity within the learning material itself. If such environments are offered online, or as e-learning systems, they act as asynchronous tools and exhibit many advantages, amongst others: (1) support of lifelong learning, (2) provision of "deep learning" through meaningful dialogs (Slack et al., 2003), (3) easy access to a broad range of multimedia information by the students, and (4) reach out for students who are not available for traditional face-to-face education.

Online Assessment (also but less commonly referred to as E-assessment) ranging from automated multiple-choice tests to more complex systems is becoming more and more common. In some of these systems the students can be focused on specific mistakes, or the system can guide the students through a series of questions adapted to what they most likely have not
learned. Nowadays, there are many automatic evaluation systems available (Williams et al., 2006).

The learning environment presented in this paper can be extended in many ways. Examples are the use of different kinds of learning contents and learning materials (video, graphics, animated texts, or games) in various languages. As an example we show some of the materials for studying the fruits of Thailand in Thai language. Other contents available are animals (for young learners) and traffic signs (for adult learners). This paper is organized as follows. After the introduction we give a brief overview of young learners and details of the system concept and framework used in this project, before we present implementation of the multimedia-enhanced learning environment. In Section 5 the online assessment component is discussed. Finally, conclusions are drawn and further work is mentioned.

2 Learning and Assessment for Young Learners

Application in teaching young learners can often be seen in first language education and mostly English as a foreign/second language (EFL/ESL) situation. For instance, in the research into computer assisted language learning (CALL), the effectiveness of teaching vocabulary has been reported in Chujyo and Nishigaki (2005). The importance of vocabulary knowledge is prominent in understanding any language. In the EFL (English as a foreign language) environment in particular, learning is generally more challenging. This is because there is little mental lexicon readily available to the learners at the early stage of learning. For instance, when learners are learning objects (such as fruits, vegetables) it is hard for learners to relate them with their meaning and their existing knowledge if they had not encountered them in their real life. Moreover, in teaching young learners in general, motivation is one of the important factors to consider since they tend to be less intrinsically driven compared to adult learners (Hirata et. al., 2008).

In the case of teaching young learners in EFL education, Chujyo and Nishigaki (2005) identify the needs to teach young learners everyday vocabulary, and they designed the E-learning course to teach English to EFL young learners. The framework for the learning process is considered by suggesting three steps: presentation, practice and performance. Having the available systems which are targeted to young learners, however, they seem to lack the attention to the evaluation stage. In the case of evaluating young learners, it is often neglected or the concept of ‘assessing’ learners being avoided for such reasons as the result could discourage learners, in case of them receiving negative results. However, it is important to consider the way to evaluate and check the understanding of the learners in any learning. It is necessary to have an evaluation stage, after any teachings and techniques used, so that it enables educators to monitor the learners’ understanding as well as the effectiveness of the techniques and approaches, which in the end, also serve as a follow-up and feed into a revision phase. The points raised above (i.e. the motivation and learning environment factors) should be feed into the design of the interface for the assessment, which will be discussed in the next section.

3 Learner-Centered System

In this section we outline the learning environment and its implementation process. In Figure 1 the learning environment is shown, with the student being confronted with yes/no questions in form of quizzes. The students have to answer every question by clicking their choices, after which the assessment component will analyse their responses. According to this analysis further
multimedia-enhanced interactive study materials are presented to the students with the help of a Multimedia Learning Object Repository (MLOR). The questions and the responses are monitored and stored in the recorder component of the learning environment.

Figure 1 Learning environment

Figure 2 System framework

The components of the system framework are described as follows:
1. Question Management is used for the management of knowledge about things and objects, e.g. fruit and animals, and the provision of yes/no questions for learners
2. Multimedia user interface is used to provide learning material and to add/edit/delete data of objects, pictures, video, and information related to material of learning
3. The object clustering technique will be used to group fruits, for example, that have similar or the same characteristics, e.g. shape, taste, smell or color. In the system framework (1) properties/characteristics (e.g., kind, shape, colour, taste, smell) are sorted and then related by classification; clustering stores any types of objects and some related properties and characteristics, (2) this will help to pose useful questions that the user has to answer, (3) supply fast access to required information
4. Inference engine tools: forward chaining (data driven) is used for finding the answer of a thing or object that the user is thinking of while using the system. The tool considers/examines all information and data from the answers provided by learners, e.g., after learners have chosen things/objects that they want to learn and revise, such as fruits, the system asks
learners about shape, taste, smell, etc. of fruits. The learners have to provide correct answers as yes or no, so that the system can get back with other questions to follow in accordance with previous learner answers and try to find out the correct answer within a minimal number of questions.

5. Backward chaining is used to recheck and trace the answers to the questions, e.g. if the correct answer is elephant (animal section) then the system rechecks all questions and answers that learners have provided, such as answering yes for 4 legs, big size, has trunk and tusk etc. From this, the learners can get full marks, if they have provided correct answers to all questions the system has generated and less marks, if they have answered incorrectly or illogically. There will be no more than 20 questions in each assessment.

6. An answer revision process is used to display questions that learners have been answered already in the session

7. An evaluation framework is used to guess the answer of a thing/object that the learner is thinking of suggested answers for each question, if learners are in need. This can assess learners’ style of learning, e.g. recognition, understanding, analysis and give marks to student after assessment


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

The learning design strategy has to take into account the learners’ specific behavior and cultural background, for instance, there is a great demand of multimedia content that has to add some fun to the learning materials.

Figure 3 to Figure 6 show parts of the interactive user interface of the learning environment with the information about jackfruits as an example. In Figure 3 the textual information about the topic to learn is presented together with some graphical information.

Figure 3 Textual information suitable for young learners

Figure 4 The Jackfruit

The MLOR repository covers various multimedia formats, e.g. audio files, being played during the learning sessions in a playful manner. In

Figure 4 an example of an audio file is presented that refers to the jackfruit. Here the
young learners have to find the right spot to click on playing the sound file.

Figure 5 shows the image map of fruits as part of the learning environment. It provides an easy way of linking various parts of the image without dividing the image into separate image files, therefore encouraging the young learners to watch and click.

5. Online Evaluation System

After learners have learnt with the information, for example about fruits, they are asked to assess their knowledge and skills of learning by online evaluation system.

The system designs the assessment as a quiz game, during which learners are asked Yes/No questions. This quiz game comes up with up to 20 questions per round. The young learners have to understand the question and relate them to their desired object. In case that the system cannot find the answer within the 20 questions the young learner gets context-sensitive help, for example through hints and explanation or contradicting and confusing yes/no answers. If the system finds the correct object, the young learner gets additional information about the object in form of graphical, audio and video materials.

The young learners get their marks after the system has successfully guessed the answer or after 20 questions without. The marks are generated according to the quality of the answers (yes/no) that the young learner has given through the assessment process.

Figure 6 shows the current question (Q8: Is it a jackfruit) in the quiz that the system is guessing together with all previous questions and answers given by the student (Q1-Q7) as follows:
Q1: Can it be used as a dessert?
Q2: Does it have an odor?
Q3: Is it big?
Q4: Is it from a big tree?
Q5: Does it taste sweet?
Q6: Does it have thick meat?
Q7: Is the meat yellow?

Figure 6 The questioning screen
6. Conclusions and Further Work

In this research we have implemented an extensible component-based system for a multimedia-enhanced learning environment that can be used for many different kinds of learning materials. The environment fosters active learning processes in that it provides interactive parts, which the students use to think about, make their choices and respond. In this paper we have presented an interactive course about fruits of Thailand as an example for learning content; other examples of multimedia-enhanced learning content include animals and traffic signs.

The learning environment presented here will be extended to various subjects and study topics. Furthermore, we will provide the environment in English and German language as well as more multiple choices for users, e.g., “not sure”, “not related”, “sometimes”, and “maybe”. Also, we will implement different kind of games to motivate and attract young learners to learning materials, including more advanced multimedia components, such as 3D animation. Moreover, we intend to setup a learning software component library together with a component server to ease the implementation of further learning systems and environments.

References


