46. Adaptive knowledge maps

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Abstract

We have developed a new Internet environment, based on Coraler map editor and an underlining data-base with interface algorithm giving proper feedback for the user, that intends to make navigation and criteria based learning easier and more effective within content material.
These tools provide the opportunity for creating topic specifics map that become more and more valuable as time passes having the potential of tracing the personal workflow of the students, which gives the teacher more information about the improvement of the students and the efficiency of the teaching material, which can be evaluated by both the teacher and the learner. The paper describes the implementation of a criteria-based English grammar course designed for individual learning, and the plans for reimplementation within an environment based on Imagine that monitors individual progress and collaboration within Colabs MINERVA project.

Keywords

E-learning, adaptive, knowledge-map

1. Introduction

Internet is the salt-and-pepper of the everyday of people living in the 21st century. We read the news, look for phone numbers, addresses, entertainment via the Internet and last but not least we apply Internet sources in our learning and teaching. However, after searching for particular topics, in most cases we experience that search engines find numerous matches making it difficult for us to choose the suitable source. First, it seems to be a good solution to use one or two educational portals which usually have reliable quality materials. However these educational portals are rather huge as well, because they would like to meet several requirements, so they struggle with similar problems like portals in general:

it is difficult to navigate within the structure of the topics

Portals usually cover not only a specific field, thus it is complicated to navigate through the broad range of topics, besides the structure of the hierarchy of particular topics is often rather difficult.

the lack of personalized methodological guidance

Supplementary materials and course materials found on portals basically need the "presence" of the teacher. (It doesn't definitely mean the physical presence of course, it can be an online contact in case of a distance learning course.) So the role of the teacher is becoming more important during the learning process, since in order to acquire a material effectively, proper methodical knowledge is indispensable. The learner needs to be advised

at any point about the next step to be taken in order to succeed in mastering the material effectively.

there is no appropriate information on the usability, the effectiveness and the success rate of the learning material

Very few educational portals contain follow-up information on the effectiveness of the materials in relation to mastering the topic with respect to different learner groups. For these kinds of evaluations it is necessary to know the student very well and a lot of information has to be collected about the progress within the course.

special needs are rarely satisfied

It is essential that educational materials should suit the current level of the learners' knowledge on a particular topic. However, portals try to suit everyone, thus they cannot satisfy individual needs.

2. Scientific background

Adaptive hypermedia systems are capable of altering the content or appearance of the hypermedia on the basis of a dynamic understanding of the individual user. Information about a particular user can be represented in a user model to alter the information presented. We define these systems as "...all hypertext and hypermedia systems which reflect some features of the user in the user model and apply this model to adapt various visible and functional aspects of the system to the user". More specifically, Adaptive Navigation Support (ANS) is a generic name for a group of techniques used in adaptive hypermedia systems (Brusilovsky, et al 1996) which use this model to provide directional assistance to the user. For example, suggesting where the user should proceed, or annotating what is learned and what is ready to be learned.

Adaptive navigation support techniques can be classified in several groups according to the way they adapt presentation of links (Brusilovsky, et al 1996), direct guidance, sorting, hiding, and annotation.

Adaptive annotation technology augments the links with a comment which informs the user about the current state of the nodes behind the annotated links (Schwarz, et al, 1996). Link annotations can be provided in textual form or in the form of visual cues, for example, using different icons, or colours, font sizes, or font types. Typically the annotation in traditional hypermedia is static that is independent of the individual user. Adaptive navigation support can be provided by dynamic user model-driven annotation. Adaptive annotation in its simplest history-based form (outlining the links to previously visited nodes) has been applied in some hypermedia systems, including several World-Wide Web browsers. Even the form adaptive annotation which distinguishes two states of links is quite useful (Eklund, et al, (1997).

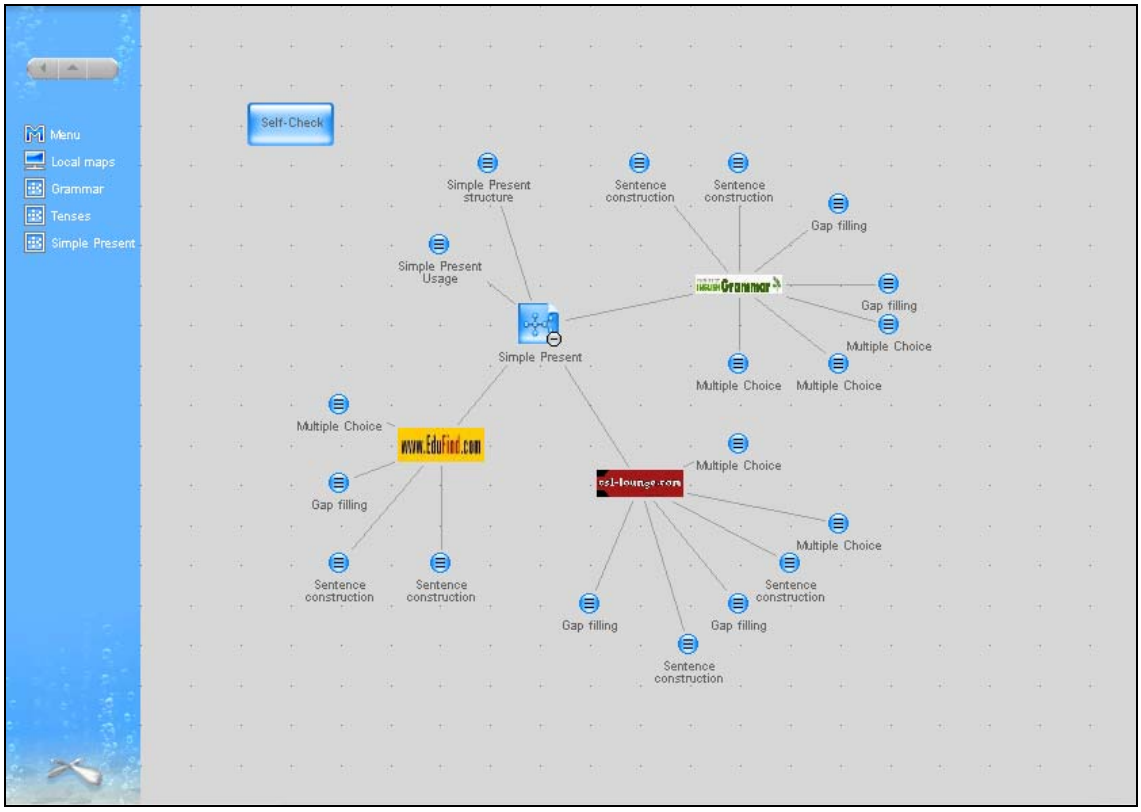
Next we present the implementation of an English grammar course using free Internet-based materials that have been structured into a criteria-based course using Coraler map editor and a supporting database.

3. The structure and the units of the material

The course consists of links to grammar explanations and exercises of quality language teaching portals. The links are classified into three levels: beginner/re-starter, pre-intermediate, intermediate. When having selected the exercises, it was essential that each of them has the self-check opportunity, which is indispensable in case of autonomous distance learning systems. Besides classifying the explanations and the exercises into levels, they are inserted into a grammar structure as well. This grammar structure suits the structure of subtopics in most language books, so students can easily recognise the structure due to evident similarities.

4. Appearance of Coraler maps

Coraler curriculum map shows the students the material in the form of a mind map that is a multilevel graph, visualizing clearly the logical and content link. (Figure 1)



Shows the nodes of a sub-map. By clicking on the nodes, a particular website opens.

5. Criteria-oriented learning

The first step when entering the course starts with a general grammar test, which examines the knowledge level of the student in each topic. Students can see a chart with their own answers given during the test and the correct answer as well. After this main test the student sees a knowledge map (a modification of the original mind map) in which the topics, where their knowledge was not satisfactory, are distinguished by different colours. This kind of colouring helps the student with navigation among the topics of the map and provides a kind of route

advised for visiting the items of the material where the knowledge of the user seems to have deficiencies.

For providing continuous feedback, students have the opportunity to fill in minor self-check tests at every particular topic. After completing the self-check tests successfully, the colouring of that particular node of the map changes to normal. Thus the student is further advised to nodes that are coloured differently.

The test questions provide an objective evaluation because each question has only one correct answer. Pedagogically, this evaluation is a kind of "criteria-oriented" evaluation. Students progress according to own abilities and the feedback about their improvement is not related to the achievement of other students taking part in the course. The aims of the examination after the end of the course is to map acquired knowledge of the student during the learning process and to identify further territories where improvements are needed, with an individual knowledge map as output.

6. The action research process carried out

The method of 'action-research' was applied in this experiment. The first version of the pilot system has been set up and the students could use it from February 2003 till April. Data has been collected on students' activities, feedbacks and emails. Evaluation of experiment is under way and the next improved session shall start in September.

7. Summary of preliminary evaluations

During the first session we could examine the progress of over 50 students.

First we analyzed the time the students spent when completing the general level test. Nearly three quarter of the students could complete their last test in less time according to their first one. Generally, the students' speed improved in solving the test by 5.8 minutes (approx 20% of the average time) on average.

Besides that, we examined how the students' knowledge improved. The students could solve the general test with a result of 64.0% on average. It shows that the difficulty level of the general test was well-created because the students average output was at the passing level.

When we analyzed the data further, we found that the most of the students significantly improved during the course (according to the result of their first test).

Upon analyzing the material, we found that the students' output was the best in the topics that they had met the most in their previous English language studies. These are for example the *personal pronouns, possessive pronouns* or *the demonstratives*. They had a lot of difficulties in the topics that are rather complex and need much practise. These are the *reported speech, passive voice* or *the causative structure.* This also indicates that the use of such e-learning materials makes sense only as auxiliary activities and does not substitute in any way normal frontal language classes.

Finally, during the examining of the tests we found that the students achieved differently in each test-question types. Their output was the best in the multiple choice type with the result of 75.0%. The students showed the lowest efficiency in the sentence reconstructing type of assignments, in which they had to rephrase a sentence using the given words. In this area their result was 23.3%. In general as we had expected before, we found that the students achieved

better in the areas that were based only on passive knowledge than in areas that needed the active language knowledge.

After this we analyzed the data and compared it with the technical and methodical expectations. Later on, considering the experiences we shall adjust the system for more effective functioning and start a new session of experimentation.

8. Further evaluation and update of nodes

Comparing the most frequently visited items in the material by the students with the topics where they showed the most improvement, it can be examined which types, styles of exercises are popular and effective in each topic. This examination can help to choose the types of exercises that turn out to be effective, and to reject the exercises that do not help the students properly in learning the particular topic on the particular level. After a period of time, and replacing the non-effective parts with new ones, as well as further upgrade of the material, it will continuously become more and more valuable.

9. Adaptation of gained experiences within the *Colabs* project

The "*Colabs*" MINERVA project aims to set up an online collaborative learning environment, which contains Imagine course materials, exercises, tests, asynchronous and synchronous co-laboratories, forums, mailing possibilities, and many more different tools for constructivist learning through collaboration. As a supplementary project Coraler map is used to trace the students' activities. In this way, the students obtain their personal maps by which they can easily navigate among the activities and opportunities of the portal.

We also provided an online mentoring service for students if needed. Mentors are assigned to different activities and students can contact mentors at their choice when help is needed. Also mentors monitor activities taking place at their area and try to provide help if they determine need for it. Mentors also set up new activities, co-laboratories depending on needs and preferences of users.

9.1. Phases of the project:

We first create advisory trajectory maps for different types of users to suggest roots to take depending on their preliminary level of proficiency, interest and aims.

We log all hits on every page belonging to the Colabs network portal and assign logs to personal profiles of users.

Using the obtained data, we create knowledge maps of individuals containing accessed trajectories, achieved test results, uploaded portfolio, points of communication and collaboration.

Using the obtained data and knowledge maps, we wish to investigate the following:

- What are the favourite activities of users, their achievements and the extent of collaboration that takes place?
- The clustering of students routes depending on the preliminary advisory trajectory maps taken to examine the typology of users.

- We examine the validity of knowledge maps in mirroring the true knowledge level of students and the ability of maps in providing assistance for teachers to determine points where assistance is needed.
- Evaluation of individual activities online and the achievements attained.
- Analysis of the association of typical clusters with typical achievements to be able to filter successful paths.
- Analysis of portfolio at points of collaboration, to be able to measure the value of collaborative activities.

Using the results of the investigation, we believe we will be able to achieve the following:

- Provide novice students with advice to start successful activities in a highly visual form.
- Provide personal knowledge maps for students to be able to review their activities and results.
- Provide personal knowledge maps for teachers about student's to review their activities, results and be able to determine where, when and what kind of support would be needed by the student.
- Provide on-going advice for students concerning the possible next steps that might lead to success.
- Provide upgraded activities that proved to be more interesting for students and produced better achievements.

10. Conclusion

At present, we are at the last phase of setting up the *Colabs* network portal and finishing the 1.st phase in providing advisory trajectory maps for different student types. The experiments are to start in May with local tests and shall grow into an international experiment starting at Eurologo workshop.

Our presentation at Eurologo shall show the results concerning the preliminary English language project, illustrate the setup of the *Colabs* mappings, their adaptive nature, and features as a knowledge map.

11. Acknowledgement

We would like to thank Coraler Corporation (http://www.coraler.com) for allowing the use of the map-editor throughout these projects.

This project has been carried out with the partial support of the European Community in the framework of the Socrates programme MINERVA 101301-CP-1-2002-1-HU-MINERVA-M.

12. Internet resources used for the material

ESL Lounge: ESL Lesson Plans, ESL Materials for Teaching English

http://www.esl-lounge.com/

English Club: learn English as a second language with English Club

http://www.englishclub.com/

ELC Study Zone

http://web2.uvcs.uvic.ca/elc/studyzone/

EduFind

http://www.edufind.com/english/grammar/

13. References

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http://www.contrib.andrew.cmu.edu/~plb/ED-MEDIA-96.html