

Asynchronous distance education: Teaching using Case Based Reasoning

Avgoustos.A. TSINAKOS
Department of Informatics,
University of Macedonia,
Thessaloniki-GREECE

Introduction

At first glance, synchronous distance education appears as one of the most appealing studying methods. Asynchronous modes of distance education combine flexible access of teaching material, self-study techniques, and peer-to-peer collaboration. However, literature also reveals a number of pedagogical drawbacks in using such a system. The indistinct monitoring of student performance/ progress, the inability to record individual learning needs, and the lack of student modeling processes (Wulf, 1996; Pernici and Casati, 1997; Relan and Gillani, 1997; Hunt 1999; Pritichard, 1998; Khan, 1997; Harasim, 1990; Hall, 1997b) are just some of the most commonly reported drawbacks.

SYIM (version 1 and 2) is a domain independent educational environment designed to remedy some of the above-mentioned educational problems (Tsinakos and Margaritis, 2001a). In this context, the employment of CBR techniques as part of the SYIM_ver2 reasoning component, is believed to further reinforce system's ability to tackle some of these reported pedagogical drawbacks.

Although CBR is a method primarily used in the field of artificial intelligence to explore a range of human cognitive behavior such as learning and problem solving techniques based on specific cases previously encountered (Han 1993, p. 8), positive results using CBR in education sessions have been also reported (Bumbaca, 1988; Riesbeck and Schank 1991).

A group of researchers, whose focus was on domain knowledge representation schemas, also conducted research examining the potentiality of CBR and its role in improving student modeling processes, which they found assisted student learning by focusing on memory structures (Bumbaca, 1988; Riesbeck and Schank 1991).

The employment of CBR in the SYIM_ver2 educational environment is believed to provide beneficial assistance both to tutors and students. The use of CBR can be used to automate the process of replying to students' questions, and contributes to the construction of new tutorial paths used to advise student on how to overcome specific performance problems. Such automated advice is based on the system's database of previous archived cases.

Employment of CBR in SYIM_ver2 Reasoning Component

The questioning process is arguably the most common interaction between the tutor and the student engaged in Web based learning. In response to questions raised by students, tutors' replies are usually emailed directly back to the student or posted on bulletin board system.

Because the class-size of an asynchronous distance education session can often be quite large, the process of answering students' questions can become onerous and time consuming. This dynamic becomes particularly true as the course progresses, because

both the number and complexity of students' questions tend to increase over time. As a result, tutors' response time to students' questions tend to increase. The downside of such delay stemming from tutors' increased workload is that some students may experience feelings of isolation. In short, students are often unable to resolve their problem in a timely manner, and rightly or wrongly they may form the impression that their distance education session lacks intense supervision.

In SYIM_ver2, which employs CBR as part of the system's reasoning component, may be solution this problem. When a student posts a query on the SYIM_ver2 system, the posting is not sent directly to the tutor, but instead, the query is recorded in the General Cases Data Base (Figure 1). The objective of this procedure is to preserve the student's personalized information, which in turn can be used for the construction of the student model by SYIM_ver2 system. In other words, this monitoring procedure enables tutors to be aware of student postings, regardless of the reply source (system or tutor).

Instead of having tutors posting replies directly to students, the Process of Identification of Similar Question (PISQ), is triggered to find a relevant case that answers a given question. The PISQ searches among the contents of the system's "Educational Knowledge Base," where questions of educational value are recorded, stored and retrieved. The PISQ provides relevant answers to questions submitted by students via an easy to use, intuitive key word search feature. Responses to students' key word searches are based on the semantic and pragmatic aspects of the question asked. In simple terms, the PISQ is designed to ensure students' search endeavors yields relevant responses to answer any questions posed.

For these reasons, PISQ employs two search methods: a controlled vocabulary search and free text search among the contents of the "Educational Knowledge Base." SYIM_ver2 also automatically displays to students relevant chapter(s) of the instructional material and a list of appropriate keywords (Tsinakos and Margaritis, 2001b). Therefore two scenarios are possible:

Scenario One Process

"No relevant case is retrieved." This prompt means that the PISQ is not able to identify and retrieve relevant case that answers the question posed. A possible reason for such failure may be that the question has not been previously raised, and therefore no response has been recorded on the Educational Knowledge Base. If this is the case, the question is then posted directly to the tutor (step 6-Figure 1), at which junction they are responsible not only for responding to student questions directly, they must also determine if the question asked can be considered a 'new case,' to be added to the Educational Knowledge Base (Figure 1, Steps 17 and18). In this manner, the Educational Knowledge Base' s content repository is regularly updated, enriched, and preserved, a process that help maintain its integrity and validity over time. In case that the student's query deemed by the tutor as not important from an educational perspective, the tutors' reply is sent directly to the student without being recorded in the Educational Knowledge Base (Figure 1, Step 19).

on how to address particular problems. Student can then select the most appropriate case among those listed (Figure 1, Steps 10 and 11), thus providing a timely answer to the question raised. Once the correct answer is processed, the "Reply to the Student" step is automatically terminated without any interference from the tutor (Figure 1, Steps 14 and 16). If a student is unable to identify a relevant case that correctly answers their question, then the "Scenario One Process" is triggered (Step 11).

An Example of CBR Based Reply

According to the above described tutor-student interaction schema available in SYIM_ver2, the student in order to post a query has to fill up a relevant query form (Figure 2). Therefore, SYIM_ver2 prompts the most relevant Topics that the query may fit in. Additionally, using the tutor constructed ontology thesaurus, the system prompts to the student the most appropriate Keywords to use (the student has also the ability to declare more than one keywords).

Post a misconception. Required fields are marked by ■

Subject:
Alignment in an html page ■

Description :
Can you please inform me how can I align text or an image in my html page?

Topic :
*aligning images ■

Keywords :(insert Keywords separated by commas)
align,text,image ■

Available Keywords :
image

Select a topic

CHARACTER FOR
*logical versus phy
*escape sequence

LINKING
*relative pathname
*urls
*links to specific s
*mailto

AddKeyword

Available Keywords

align
text
graphic
find
image
background
color
button
music
html

Figure 2: Query posting Form

Once the student fills in all the required fields of the form and posts the question, the PISQ process is triggered.

In case where "Scenario a" becomes valid, the tutor has to answer the question and therefore has to decide if the current question should be stored in the Educational Knowledge Base, for further reference.

In case where the "Scenario b" becomes true, SYIM_ver2, provides the ability to the student to select among three groups of retrieval sets (if any). The first retrieval set displays the search results of PISQ, of the similar cases found among the contents of the Educational Knowledge Base, which have been posted under a specific subtopic of the teaching material (Figure 3).

View all misconceptions for this assignment Search the whole Knowledge Base

If no relevant answer is found, your question will be answered by the instructor

Keyword Matches Found

Graphic and text alignment
How do I align text next to a graphic in order to avoid abnormal lay out?

Free-Text Matches Found

<p>Subject: Graphic and text alignment</p> <p>Body: How do I align text next to a graphic in order to avoid abnormal lay out?</p> <p>This posting answers my question View the whole discussion or 'bottom.)</p>	<p>Topic: Graphic and text alignment</p> <p>How do I align text next to a graphic in order to avoid abnormal lay out?</p> <p>By including the "align" element in the "img" tag, {IMG SRC="wflower.jpg" WIDTH="25" HEIGHT="25" ALIGN="top" BORDER="0" ALT="wildflower photo"} Photo of wildflowers in Texas {/A} (The align="top" would align the text "Photo of wildflowers in Texas" next to the graphic at the top. - Other options are "middle" or "bottom.")</p>
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Figure 3: First group of Similar cases retrieval set

The second group displays the search results of PISQ among the contents of the similar cases of the Educational Knowledge Base regardless the subtopic that they have been posted (Figure 4).

View all misconceptions for this assignment Search the specific subtopic

If no relevant answer is found, your question will be answered by the instructor

Keyword Matches Found

Alignment problem
How do I align text to the center so that the page lay out to look nice?

Body structure
What kind of text can I include in the body section of the html page?

Pictures as backgrounds...
I would like to know how do I use a picture as the background of my page? Can I use any kind of pictures?

Background color modifications
How do I change the color of my background or text?

Table alignment
How do I align a table?

Text intention
How do I indent a lot of text?

Image as button
How do I use an image instead of the standard submit button?

Images as links
Can I use an image as a link for any kind of external url (http or ftp)?

Free-Text Matches Found

Background color modifications
How do I change the color of my background or text?

Body structure
What kind of text can I include in the body section of the html page?

Text intention

Figure 4: Second group of Similar cases retrieval set

The student can select the second group of retrieval set by clicking on the "Search the whole Knowledge Base" option (Figure 3). Similarly, the student by clicking on the "Search the specific subtopic" option (Figure 4) is able to review the first group of the retrieval set.

The student, in both groups, is able to check the content of a similar query (case), which

may answers his/hers own one. To do this, the student has to click on the relevant Title of the query (Figure 3). Note that in the above Figures 3 and 4, both the results of "keyword search" and of the "free text search" are displayed as the PISQ uses both search techniques.

It is worth to mention that a retrieve case may include, as part of its contents, a number of student-tutor nested dialogue messages which formulate a chain of navigational tutoring steps (tutoring paths) on how a student can overcome a particular problem.

The third group of retrieval set, if free of CBR techniques, and displays all the misconceptions-queries (regardless their similarity to the once posted) that have been asked during the specific assignment that is linked to the material chapters that the students query is related. This group of retrievals is available under the "View all misconceptions for this assignment" option.

Note that for ethical reasons, all the retrieval sets of questions-cases, are detached from any elements linked to the identity of their owner (the student who has originally posted the particular question).

Once a similar query that answers student's initial question is identified, the student has to click on the available option "This posting answers my question" (Figure 3). Having done this, student's query is marked by SYIM_ver2 as an answered one, without reaching the tutor. In addition, the system updates student's personal model, by monitoring that the current question has been answered by the system. This feature is extremely useful for the tutor, as the latter has a detailed report linked to each student particular questions, even in case that all the student's questions have been answered by the system, without having ever reached the tutor for a response.

Conclusions.

Asynchronous distance education, beyond the fact that is one of the most popular education sessions, is also linked in the literature with a number of pedagogical drawbacks.

SYIM_ver2 is a domain independent educational environment, which has been developed in order to remedy some of the educational problems, appear in asynchronous distance education.

Employment of Case Based Reasoning techniques as part of the SYIM reasoning component, aimed to automate the process of replying to the student's questions, by identifying relevant ones that have been already asked by other students and are stored in system's Educational Knowledge Base

Considering that a number of students' queries appear repeatedly during an instructional session, PISQ process may proved to be a time saving feature. On the other hand, this feature is also beneficial for the students as they can easily find a pre stored answers to their question and therefore they can proceed in the instructional material without time delays due to the inability of the tutor to provide an immediate answer. A further benefit regards the multiple display retrieval sets. That is that a number of queries are displayed to the student and therefore the latter can identify, explore and resolve some other critical

instructional concepts.

In conclusion, the employment of CBR as described above, may assist both the tutors and the students. It may proved as being a time saving feature for the tutors during their instruction by decreasing the number of the questions seeking for an answer. Also may accelerate the instructional process and contribute to the content comprehension on the students' side.

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