

RABILDA

Evaluation of an eLearning System for Radiology

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Abstract

In this study we take a closer look at the introduction of the Rabilda eLearning environment. Rabilda allows medical students of radiology to work with realistic caustics, under the guidance of the system. Through Rabilda, one has tried to exploit the advantages of online, multimedia techniques, offering students a system that they can use any time from any place. The idea of Rabilda is not to replace existing teaching methods, but to work together with these.

The result of the study show that students overall are very satisfied with a system that allow them to work at leisure with realistic cases, giving them the training that they will need as medical practitioners. Students find the system easy to use, and also less demanding on their concentration than lectures and textbooks. The system is therefore often used from students' homes in the evening, after other, more demanding, tasks have been performed.

Introduction

Today, educational institutions are expected to provide students access to Internet-based applications to support traditional teaching. These systems may be anything from simple student-administrative systems to full eLearning environments. The latter, designed to offer students an alternative learning or training arrangement through the Internet, can be important contributions to existing educational programs. It is important that the consequences of the implementation of such electronic tools for learning are thoroughly reviewed before the systems are implemented. It is too easy to focus on the technological possibilities alone.

In this paper, we will study a prototype of the system Rabilda (Radiological Database), developed as a support system for students of radiology at Haukeland University Hospital in Bergen, with emphasis to what extent the system is suitable as a supplement to more traditional educational programs.

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eLearning systems - what can they offer?

The Internet has become an important means of communication in our culture. During the last few years, there has been much attention on the Internet as an aid in learning- and training situations (Maleck and Fischer, 2001; Riva, 2001; McBride et al 1998). McBride calls attention to two important factors that contribute to this development. First and foremost, the general use of computers and the Internet are increasing. In addition, at a time where the institutions are confronted with demands to cut their expenses, eLearning systems may be a way to offer individualized teaching without adding human teaching resources (McBride et al, 1998; Brahler et al, 1999; Driscoll, 1998). Further, electronic teaching systems offer the possibility of distance learning, which allows students to access the systems from anywhere at any time. Revision of the educational material will also be performed more efficiently over the Internet than on paper. Riva claims “we are in the midst of a paradigm shift in education and training from classroom centric to network centric” (2001).

eLearning systems based on the Internet generally offer a presentation of instruction and supporting material. Compared to previous eLearning environments Internet-based systems have the advantage that the users may already be connected, and that the new systems can piggyback on existing standards (such as HTML and HTTP) and existing software (browsers, HTML editors). For many applications it is also important that an Internet based solution automatically includes possibilities of two-way communication between teacher/system and student, or among students.

eLearning systems based on computer networks offer a spectre of new possibilities of presentation and organization of information. Educational material of different formats can, by using hyperlinks on Internet pages, be made accessible for students, regardless of where and when the students would want to access them. Text, sound and different types of graphics can be integrated, creating hypermedia systems. In the simple case eLearning systems are being combined with traditional classroom teaching such as lectures and teamwork. With such an add-on philosophy the advantages of traditional teaching can be upheld, at the same time as one can exploit the possibilities offered by the new technology (Brahler et al., 1999). Several researchers also claim that presentation of material by using text, sound and graphics, may enhance the effect of learning (Anderson and Mayer, 1991). Research also shows that eLearning systems allow students to get more involved in the learning process (Burton et al, 1996).

There are, however, challenges connected to the introduction and use of new electronic teaching aids. The development expenses of the more technically advanced eLearning systems can become extensive, in fact, so extensive that a prospective profit does not coincide with the resources that are being used in the development and use of the system (Olsen, 2003). Secondly comes the problem of transferring already existing teaching material from the physical classroom to a “virtual” classroom (Brahler et al, 1999), *not* a simple copy from one format to the other. In most cases it will be necessary to develop new material, in order to utilize the new technological advantages. Further, it may be necessary to modify traditional teaching methods in order to maximize the utility of the Internet-based eLearning systems (Brahler et al, 1999; Driscoll, 1998).

eLearning systems should be simple and easy to use. If an electronic eLearning system does not seem to be user-friendly, or if it does not meet the user's demands for functionality, the result may be that the system is not being used to the extent that it was meant to be by the initiators (Shneiderman, 1998; Nielsen, 1995). It is also a danger that the system itself, if badly designed, will reduce learning possibilities, as students get too focused on the operational part of the system. It is therefore not given that the introduction of an electronic system within any area will increase the efficiency or effectiveness of a learning environment.

Even if eLearning systems have been in use for a number of years already, there is still no consensus concerning which criteria should be met to develop efficient systems. There has been little research that can offer hints towards which criteria concerning design and integration of electronic teaching and learning systems that have proved to be successful (Riva, 2001). While we want to exploit the opportunities that Internet-based computer systems can offer in a learning situation, we must also show that the systems are justifiable from an educational and economical perspective.

Rabilda



Figure 1. Lecturing a group of students with the aid of a light box to display radiological cases.

In their 6th year of study, the medical students go through an extensive training in medical radiology. The students are offered regular lectures, as well as group-based training. This particular training is based on casuistry. Radiological pictures are presented using a light box (Figure 1), giving the students the opportunity to discuss findings in plenum. The students also work individually with their textbooks and radiological illustrations available at Haukeland. A close up of a radiological picture is presented in Figure 2.

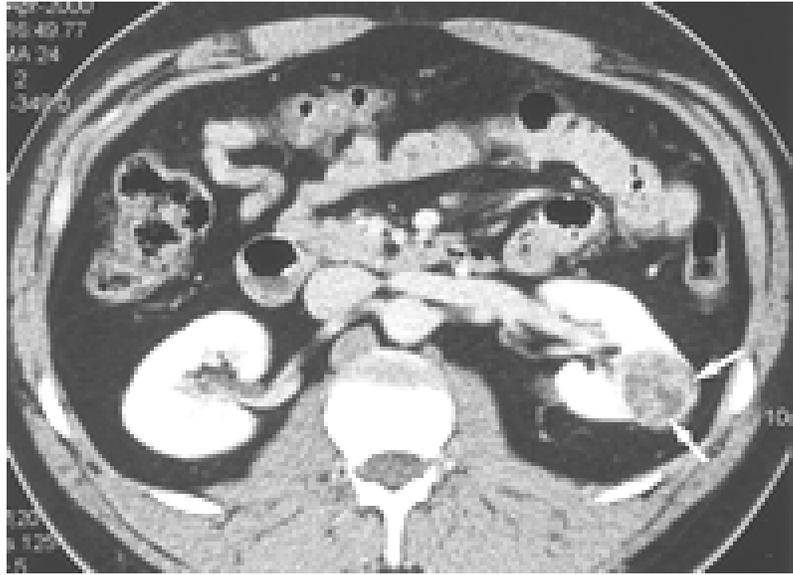


Figure 2. A Computer Tomography scan illustrating a tumour after iodine contrast has been injected. The accumulation of contrast fluid shows that this is a solid tumour and not a cyst. In this specific case we can observe a malign tumour in the left kidney (as indicated by arrows on the right side of the scan).

Increased enrolment at the University has led to an increase in group size. According to the faculty, this affects the learning environment. It is, for instance, harder for the students to follow the teaching in radiology, which mostly takes place at the podium where the teacher stands, when the group sizes increase. In addition, it seems as if the students are less willing to take an initiative if the group exceeds a certain number of people.

To counter this, an Internet based system called Rabilda was developed. The rationale for the system is based on the assumption that radiological learning material can be integrated in an electronic learning environment in an appropriate way, presenting radiological casuistics containing both pictures and text on the Internet. In addition, an Internet based system will enable students to access radiological learning material independently of time and place. Further, such a system may also allow the students to engage more actively in the material, to enhance the individual activities of the students, both in relation to the increased number of students in the group and the new way of working with the material.

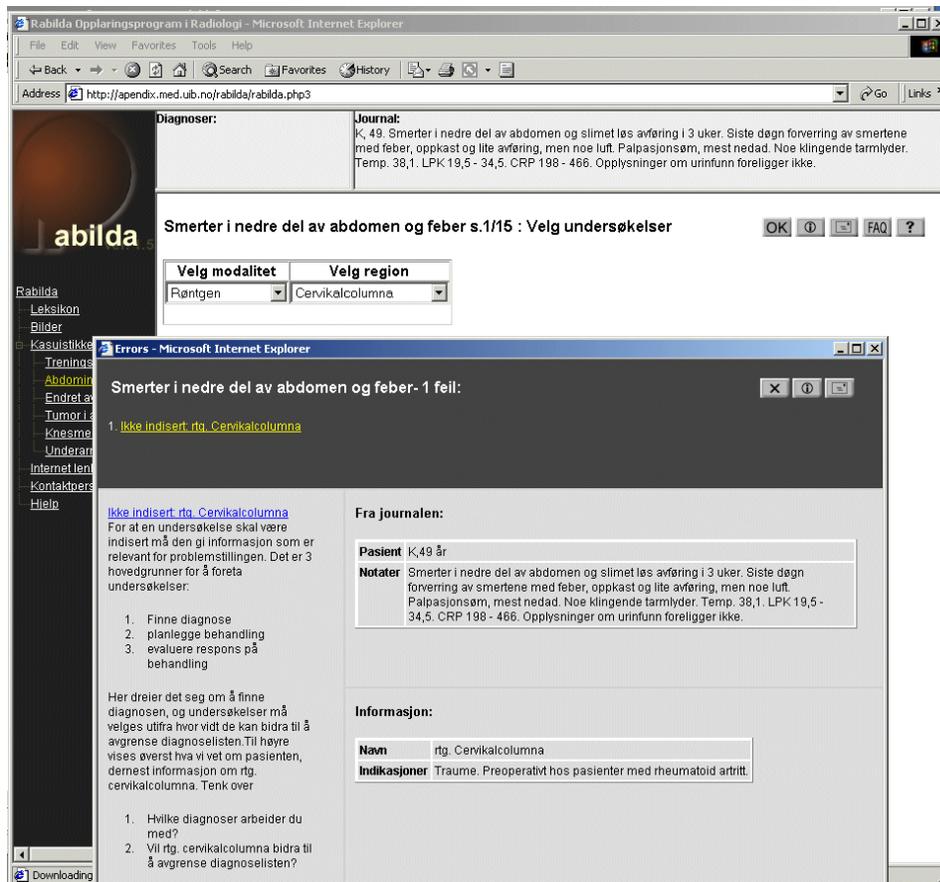


Figure 3. Example: Abdominal pain, page 1 of 15 (in Norwegian)

Rabilda is, as of today, as good as fully implemented. The faculty wants to increase the number of casuistics in the near future, so that various cases can be represented. The idea is to train the students to look for patterns and to find methods of assessment instead of simply learning casuistics.

An example page for such a casuistic is presented in Figure 3. The case presents medical history, results of examinations, medical record data as well as radiological pictures. The job for the student is to work towards a diagnosis. The case presented in Figure 3 is a typical task in Rabilda, where the student is permitted to choose both modality and region, based on the symptoms presented. In this case an incorrect answer has been chosen, and a window is activated which notifies the student of the error and gives the student guidelines for further work on the clinical picture presented in the casuistic.

The cases presented to the students have been developed by the radiology teachers in such a way that they correspond to the clinical situations that the students will meet in the real world.

Evaluation of Rabilda

It is important to ask the following question: What effect does Rabilda have on the learning situation? Such a question is hard to answer (Collins, 2000; Carswell et al, 2000). Maleck and Fischer have, however, found that students of radiology using

casuistics-based eLearning systems can improve their ability to solve radiological problems (2001). Such findings may be due to the fact that students may view electronic learning system more interesting and activating than textbooks, and that this leads to an increase their activity level (Säljö, 2001; Brahler et al, 1999).

This study investigates the students' attitude towards using Rabilda. A questionnaire was used to examine the following topics: students general knowledge of the use of Internet-based applications; whether or not they perceive Rabilda as useful with respect to contents and presentation of the material, and whether the implementation offers the flexibility needed to be a practical tool for the students. The second part of the investigation was more qualitative, built on interviews and observation of students while they were working on a selection of medical cases by using Rabilda. The aim was to study their line of progress while working on the assignments presented by the system.

25 of the 60 students who studied medicine in their 6th year in autumn 2001 at Haukeland University Hospital, volunteered to participate in the evaluation. These 25 students, 13 men and 12 women between 24 and 31 years of age, first received an introduction of the use of Rabilda as well as the rationale for its development. The evaluation set up was presented to the students, before they received the questionnaires. The students were then given selected casuistics to work with for one week. They could freely choose whether they wanted to work from home or at the university computer lab. In both cases they would be able to contact the developer of Rabilda (who has a background in both medicine and IT), or their respective lecturers by email or phone in case any problems should arise, or if they had questions related to the evaluation or the eLearning system. After this week, the students were summoned to a meeting where they could share their experiences, ask questions and hand over their questionnaires.

A "guide to interview" was then developed, which formed the basis for the participatory observation of the users who participated in the qualitative part of the examination. In this second part of the study, which took place in one of the medical departments' computer laboratories, 6 students used Rabilda as they worked through selected casuistics. They were asked to make comments to and give their reasons for the choices they made while using the system. As the students were working with the system they were asked questions related to the user interface and were invited to comment on the interface. This input was used to study to what extent the user interface could be said to be developed in accordance with acknowledged guidelines for design of applications, such as Nielsen's "usability heuristics" (Nielsen, 1995). The students were also asked whether or not they found the system to be a practical supplement to the existing teaching environment, and whether they had opinions on how the system, if possible, could be improved.

Results and Discussion

During the evaluation of Rabilda only 5 casuistics were presented to the students. This was done to ensure that the students were working on the same assignments, so that the comparison of the students' feedback would be easier. The casuistics that were presented contains between 7 and 20 different pages with multiple choice questions or pictures related to the specific case. The students were to set a tenta-

tive diagnosis and suggest examinations and treatments for the patients based on medical records, other information about the patients and radiological pictures.

To examine the students' motivation for using Rabilda as a support to traditional teaching, as well as trying to establish what kind of computer-technological skills the students possessed, the respondents were asked questions related to the use of computers and different types of applications. The data show that a great majority of the respondents have made use of and are familiar with email and Internet-based applications, which are important elements in Rabilda. A majority of the students had a positive attitude to the use of electronic learning systems. All of the respondents said that they felt that Rabilda to some extent (11 out of 25), or to a great extent (14 out of 25) could contribute to an increased understanding of radiology.

When it comes to the actual use of Rabilda almost all of the students reported that they had no problems with downloading Rabilda from the server (24 out of 25 students). None of the students reported serious technical problems. When asked whether or not they thought Rabilda provided enough information for the students to work with the casuistics presented to them, the students answered that they did get the information needed, when it was needed. Even the few students without prior experience with computers obviously did understand how to solve the problems presented. Most of the students spent not more than approximately ten minutes to learn how to use Rabilda (16 of 25 students). Another interesting aspect related to user-friendliness is the report that only five of the students ever used the help-function in Rabilda. This seems to show that Rabilda is reasonably easy to learn and to use.

All of the students participating in the study pointed out that Rabilda was very suitable as a tool combining both practical and theoretical aspects of radiology. The students strongly emphasized that the introduction of Rabilda improves the learning environment, however, only as long as it is used as a supplement to the existing teaching of radiology (24 of 25 students). Some students fear that introducing Rabilda will lead to less focus on the existing lectures and group work (this is clearly a possible scenario, i.e., that the institution chose to take the advantages out as a monetary saving instead of a increase in quality).

The students reported that they experienced a higher level of activity when working with the casuistics in Rabilda, compared to their normal activity during the group-based training. The most distinctive discovery was that students reported that they during the evaluation period spent more time working with radiological learning material than earlier. The reason for this was assumed to be that working with a training system allowed the students to practice on radiological methodologies and to use methods that they had already learned. While most students found it tiresome to use textbooks after finishing the day at Haukeland, they reported that it was quite easy to work with Rabilda. Students reported that the reason for this was that Rabilda was found not to require the same level of effort and energy, as would textbooks with topics similar to what is presented through Rabilda.

Another important aspect of the students' level of activity is that Rabilda was found to allow them to work with radiological material in a new manner. Compared to existing methods Rabilda offers the students the possibility to manipulate the radiological pictures presented, to work in their own pace, and to refer to text-

books and other sources of information if necessary. Rabilda was also found to give a broader presentation of the cases, allowing the students to examine actual cases in a new way. Thus the students could try a greater spectrum of approaches to radiology and available investigation methods than before.

When asked whether the respondents find Rabilda relevant to radiology, 18 respondents find it “relevant to a great extent”, and 7 respondents “to some extent”. The results indicate that the respondents are fundamentally positive to the introduction of Rabilda as a support to the teaching that is already offered to the students of radiology. In particular, the flexibility offered with respect to the teaching material is perceived as very useful.

Philips et al. have pointed out the difficulty of being able to present radiological picture material of sufficient quality when the material is scanned and transformed into digital material (2001). In our case only 2 out of the 25 respondents answered that the quality was insufficient to identify detailed structures. The developers of Rabilda have, however, put great emphasis on quality, so that structures can be identified without any doubt. Obviously, the radiological pictures did provide enough information for the students to work with the different cases. Furthermore, it was not reported that the system contained information that was perceived as incorrect. The students trusted the content of the web based system, perhaps due to the fact that they knew that their own teachers had participated in the process of developing the casuistics.

Rabilda has been successful of increasing the students’ active involvement with the cases, something that was clearly not possible with the existing group-oriented system using a light box. According to the comments from several of the students, this increased the time students used on radiology. An overview of the most important findings is presented in Figure 4.

Our simple tests have given valuable input to the system development, mostly with regard to the user interface and in the formation of casuistics. A more comprehensive test, over several years and involving more students, would have been interesting to perform. However, as any other system Rabilda has to compete in the marketplace, in our case mostly with existing teaching methods. This is perhaps the best test of the benefit of a system.

Survey data:

- The students were pleased with Rabilda and wish to use the system as a supplement to the existing instruction at the Department of Radiology (25 of 25)
- Highly motivated to use the system (24 of 25)
- The students want a larger amount of casuistics to be developed.
- The information presented through Rabilda occurs to be correct and easy to understand (22 of 25)
- One can use the system independent of time and place (25 of 25)
- Rabilda can easily be used as a complement to existing instruction (25 of 25)

The following observations are based on interviews with the students:

- The system offers new teaching tools and methods.
- Most students report that they now spend more time on radiology.
- The students believe that the radiological casuistics presented through Rabilda would be closely connected to the clinical situations that they expect to meet after finishing their education.

Figure 4. An overview of the most important findings.

Conclusion and Future Work

In this paper we have presented the pilot introduction of an electronic learning system, Rabilda, at Haukeland University Hospital, Norway. This investigation shows that students can work actively with radiological casuistics through Rabilda. The system provides students with new perspectives, since the integration of different techniques for presenting information allows the students to work with radiological material in a new way. In particular, the students feel that the system allow them to work individually or in groups with realistic medical cases.

According to existing plans, students will start using Rabilda as an integrated part of the radiology courses offered at Haukeland, by autumn 2003. The existing teaching environment will be modified to include the system. Medical cases presented in Rabilda will be introduced and discussed during the lectures on radiology wherever this is appropriate. It is worth noting that Rabilda only will be used as a complementally tool. As a consequence, the students will still be able to attend the normal classes and discuss radiological problems with fellow students and lecturers at the Section of Radiology.

The section of Rabilda containing the casuistics will be expanded in the future. A newer version of the editor used to develop the casuistics has recently been

launched. This improved tool for developing casuistics will make the process of producing new sets of cases less time consuming, and therefore also less expensive.

The design of Rabilda has been changed as a consequence of the evaluation presented in this paper. Both the underlying database and the user interface have been changed in order for the system to work more efficiently. As a result the users can work with Rabilda in a much more flexible way than before.

Acknowledgements

The authors would like to thank Jarle Rørvik, Lars-Gunnar Hartveit, Konrad Morgan, Barbara Wasson, Stig Mjelstad and Kristine Sevik for their invaluable advice. We would also like to thank colleagues at the Department of Information Science, University of Bergen, for helpful comments.

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