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Abstract: In 2000 – 2001 the Department of Communication, Journalism and Computer Science at Roskilde University together with UIAH Media Lab, University of Art and Design, Helsinki, and the Centre for Research in Networked Learning and Knowledge Building, University of Helsinki have participated in a project to develop and evaluate the Future Learning Environment 2 (FLE2) software for collaborative learning. This report is Roskilde University's contribution to the evaluation of FLE2.

Keywords: Future Learning Environment 2, software evaluation, problem oriented learning

FLE 2 at Roskilde University

In 2000 – 2001 the Department of Communication, Journalism and Computer Science at Roskilde University together with UIAH Media Lab, University of Art and Design, Helsinki, and the Centre for Research in Networked Learning and Knowledge Building, University of Helsinki have participated in a project to develop and evaluate the Future Learning Environment 2 (FLE2) software for collaborative learning.

In accordance with the project plan evaluation has focused on these issues:

"Are the users satisfied by the functionality provided by the system? How does FLE2 support current practices of learning and instruction at university?

Does the usage of the FLE2 system improve the quality and efficiency of the work of the users?

How easy is the system to use from the viewpoint of the students and teachers (user-friendliness)? What kind of support would the users need in order to be able to use the environment in an effective way?

For which type of applications is it particularly good? Which extensions or enhancements might be required to extend its application area?

In addition, of course, the usual criteria for software products such as required resources for installation and maintenance, robustness, performance, and quality of documentation will be evaluated, primarily from the users' point of view.

Further, the pedagogical outcomes such as the general mediation of skills and knowledge among the members of the learning community will be evaluated. A central goal of the evaluation task will be the use of tools for searching information, representing ideas and modelling expert-like interaction with new and often excessive amounts of information. Further, the evaluation will examine the tutors ability to provide guidance and support, which

in general depends critically on how they are able to monitor the progress of individual learners or groups." (Leinonen, Muukkonen, & Cheesman 2000).

At Roskilde University we have been particularly interested in studying to what extent the innovative features of FLE2 can be integrated into academic life at our university:

"In the search for a useful environment for problem-based learning we have discarded several commercial products, and have mainly used a proprietary UNIX-based (pearl) scripted conferencing system. With the continued development of BSCW system, we have found this to be closer to our functionality needs, but without the ease of use and needed adaptation to an educational setting. We are therefore eager to co-operate with the original developers of FLE in order to approach a system that can be integrated into the pedagogical model of Roskilde University." (Leinonen, Muukkonen, & Cheesman 2000).

The Roskilde University setting

Since 1972 studies at Roskilde University have been based upon problem-oriented project work performed by students working in groups. Typically, students form groups at the beginning of each term. On the undergraduate level groups may be quite large (up to ten students). At the graduate level smaller groups of two to six students are common, and some students choose to work on individual projects. A supervisor is appointed to each project. Groups are formed on the basis of common interest in a problem or a topic that may be defined rather freely within the framework of an interdisciplinary theme – subject to approval by the supervisor. Project work deals with real life problems, and the nature and development of the project is determined by the approach used by the group. Groups learn mainly by reading, discussing and contacting relevant people, institutions and firms. Progress is reviewed at tutorials, and at the end of the term a project report has to be submitted for evaluation.

In addition to project work the students are required to take a number of courses. Courses deal with theoretical issues in Communication Studies, methodology or with the practical application of theories and methods in productive work. At the Department of Communication, Journalism and Computer Science, where FLE2 has been tested, project work accounts for 60% of the workload (18 ECTS points per term), courses for 40% (12 ECTS points, a course constituting 3, 4 or 6 ECTS points).

The FLE2 test courses have all been 3 ECTS point courses, i.e. each constituting 10% of the term workload. 3 ECTS points roughly equal two weeks of full time work and are prescribed to involve a maximum of 18 classroom hours.

The courses

1 Knowledge-building Environments

The course in *Knowledge-building Environments* was offered by the UIAH MediaLab and the Department of Psychology, University of Helsinki. It was directed by professor Kai Hakkarainen. Several faculty members from the two Finnish institutions participated in the group work as informal tutors. Originally scheduled for November – December 2000 the course was extended until late January 2001 in order to stimulate further online-discussions. The course was an exercise in learning by doing – discussing the principles of inquiry learning and the use of collaborative tools for knowledge building through actual use of the software designed to support this kind of learning. It was also an experiment in distributed teaching using video-conferences. The course consisted of five videoconference sessions (including lectures and synchronous discussions with the lecturer as well as fellow students in the various work groups) leading up to net based discussions. Following each videoconference session was a

synchronous online discussion lasting for an hour or two, and the discussion continued asynchronously in FLE2 until the next videoconference. At the end of the course each participant was required to produce a brief summary of his or her knowledge-building experience. The course was in English. 15 – 20 Finnish students participated in the course – in Real Life as far as the lectures are concerned. 5 Danish students participated as distance education students. The course was evaluated by CBS LearningLab, and a written report was produced (Skalts & Brandt-Lassen 2001).

2 Hypertext seminar

In November – December 2000 FLE 2 was introduced as a discussion tool for 26 first-year students enrolled in the *Master of Computer-mediated Communication* programme, an Open University programme at Roskilde University (http://www.mcc.ruc.dk). The objective was to use FLE 2 as a conference system for a net seminar on hypertext theory. This seminar was to supplement the main activity, which was for each student individually to produce a hypertext application illustrating the practical implementation of theory. Ms. Minna Lakkala, Center for Research in Networked Learning and Knowledge Building, University of Helsinki introduced the FLE 2 system and the concepts of progressive inquiry to the students by means of a lecture and some exercises at a weekend seminar in the town of Svaneke, Denmark. The subsequent discussion in Danish was moderated by Simon Heilesen and monitored by Robin Cheesman. Because of the rather low level of activity in this seminar, a formal evaluation of this net seminar has not taken place.

3 Methods in Internet Research

The course in English *Methods in Internet Research* was offered jointly by Roskilde University and Aarhus University in March – April 2001. It was directed by senior lecturers Joergen Bang (Aarhus University), Robin Cheesman and Simon Heilesen (Roskilde University) and part time lecturer Eva Ekeblad (Roskilde University). The course was an experiment in distributed teaching and learning where each of the four instructors in turn headed a net seminar for students from the two institutions. A total of 44 students were enrolled in the course, of whom 36 students participated actively (22 from Roskilde University, 14 of whom were foreign students). At Roskilde University there were face-to-face classes at the beginning and end of the course. At Aarhus University there was only a face-to-face class at the beginning of the course, but the students in the course met regularly for other classes. At the conclusion of the course the Roskilde University students were required to write a short essay on a subject discussed in the course. The course was designed to test FLE2 as a conference system in a net based learning process. The course was evaluated by CBS LearningLab, and a written report was produced (Thomsen 2001). The experiences from the course have also been the subject of a conference paper (Heilesen, Thomsen & Cheesman 2002) and a M.A.-thesis (Fjelsten 2002).

4 Collaboration and Learning in CMC environments

The course *Collaboration and learning in CMC environments* was offered by Roskilde University in September – November 2001. The course was in English and was meant to attract both Danish students and foreign students at Roskilde University. The course was directed by Robin Cheesman and Simon Heilesen. Jiri Lallimo of Helsinki University and Haakon Tolsby from Aalborg University participated once each as guest lecturers. 15 students enrolled in the course (six foreign students) which consisted of six classroom lectures followed by asynchronous discussion in FLE2. One of the discussions involved a small project in which the participants were to evaluate a distance education software package. At the conclusion of the course the students were required to write an essay on a subject discussed in the course. The course was designed to test in a Roskilde University pedagogical setting the

interplay between regular classes and online discussions that are the recommended use of the FLE2 system. The course was evaluated by CBS LearningLab, and a written report was produced (Thomsen & Shahid 2002a). The evaluators have also the course as the subject for a conference paper (Thomsen & Shahid 2002b).

The many facets of the evaluation

The evaluation reports supplemented by the experiences of the faculty involved in the courses raise a large number of issues. Some of them have direct bearing on the FLE2 software and the particular use of it in the courses. Others have not, but are nonetheless important to consider when discussing computer-mediated education in general. In this report first we will do a critical review of our experiences using FLE2 as a platform. Next we will try to answer the questions formulated in the project plan by drawing on the positive lessons that can be drawn from the evaluation project. For the first part of the presentation, we have chosen to group the issues in this way:

- Test design,

- Design and planning of the courses,

- Integration of the courses in the educational programmes,

- Pedagogical issues,

- FLE2 interface and functionality,

- Technical and administrative matters.

Inevitably, there is some overlapping between these categories, but it will serve as a framework in the discussion below.

Test design

The four courses making use of FLE2 have been designed to test the system under different conditions, and also to bring into play different approaches to teaching. All tests have been planned on two assumptions:

1. The courses should be integrated into the regular academic programmes of the institutions involved, i.e.: as far as possible course content should be part of the syllabus, the courses should be integrated into the regular teaching schedules, and teaching methods should not radically depart from the accepted norm of the institutions involved.

2. The courses should be designed thoroughly to test the FLE2 system's capabilities in various situations where one would normally consider using a groupware product. This means that in the courses run by Roskilde University we have not limited testing to accord with the rather specialized purpose for which FLE2 is allegedly designed, but have tried to establish the limits for its use, challenging rather than just following the suggestions for "proper use".

It should be noted that we have had no intention to evaluate the kind of progressive inquiry pedagogy named FLE2 pedagogy. Nor have we tried to evaluate how successfully it has been implemented in the software product.

The various parameters involved in the test design can be summarized as follows:

Course 1: Face-to-face classes supplemented by FLE2, mixed physical and virtual presence in classes, collaboration between three institutions, medium sized class, regular university programme, FLE2 pedagogy.

Course 2: Net based seminar making use of FLE2 as discussion forum, virtual presence only, one institution involved, medium sized class, Open University programme, Roskilde University pedagogy for net based education.

Course 3: Mainly net based using FLE2 as a discussion forum, collaboration between two institutions, large class, regular university programme, Roskilde University pedagogy.

Course 4: Face-to-face classes supplemented by FLE2, FLE2 used for discussions and project work, one institution involved, medium sized class, regular university programme, Roskilde University pedagogy.

Our approach to testing has been subject to some debate with the FLE2 development team along the way, and it has also been criticized in the evaluation reports. The contention is that if we had adhered closely to the cycle of FLE2 inquiry and kept within the – initially not too explicit – limits of recommended use of the system, we would have produced better quality courses. Pedagogical evaluation is the focal point in such criticism, and it somewhat misses the point that the reason for testing the product outside the R&D original environment is to see if it can be used in other educational settings than the one it was commissioned for. This is also plainly stated in the project plan.

Admittedly, none of the courses have been really successful or even up to the standards normally required at Roskilde University. But several different factors are involved, as we will discuss below.

Designing and planning the courses

Course design and planning presented numerous problems that have contributed to the somewhat limited success of the courses. In at least two instances we have clearly tried to achieve too much at once. Thus in course no. 1 the experiment with videoconferencing and mixed physical/virtual classrooms eventually dominated the course and was detrimental to the motivation of the students. In course no. 3 the idea of combining two courses at different universities and bringing in online teachers from various places caused confusion among teachers as well as students.

In courses 1 and 2 the FLE2 pedagogy was introduced to the students by using the FLE2 pedagogy, asking the students to formulate research questions right from the start. This also is an example of trying to achieve too much at once. In both cases the Danish participants were at a loss. Not having any prior knowledge of progressive inquiry pedagogy (PI) they experienced a complete lack of structure and purpose of the course. In course no. 1, the subject of which was in fact PI, the students eventually – and late – realized what it was all about. But in course no. 2, where the FLE2 brand of PI was not supposed to be used at all, the experience resulted in a hostile attitude towards the FLE2 system and a reluctance to use it.

In courses no. 1 and 3 it became quite evident that differences in academic culture must be taken into account when planning joint courses. Differences were quite pronounced not just between institutions in different countries, but also between universities in the same country. So was the approach to pedagogy, and it has become very clear that careful coordination of the pedagogical approach to be used is as important if not more so than scheduling and planning course content.

Technical planning is also important. Insufficient technical planning and apparent inexperience with the medium caused major problems in course no. 1 and very nearly ruined it. Insufficient technical coordination created near-chaos at the start of course no. 3, because FLE2 was unavailable due to system work.

On a less critical scale, getting the students into the system in several instances proved to be an obstacle, suggesting that technical planning must also include an extended pre-course period of registration and support.

To the teachers in courses 2, 3 and 4, course design was a process of trial and error. Especially course no. 3 suffered from a mistaken choice of design. It was structured as one course for some 40 students who were to be divided into groups, and it displayed the entire course structure right from the start and all on one screen. This resulted in an unmanageable user interface, as we will discuss in the section on functionality.

In courses 1 and 3 attempts were made to do course planning by means of FLE2, the assumption being that it would be useful for the instructors to practice using the system and to be able to see course structure and suggestions for content in a prototype of the course. But eventually all planning switched back to e-mail, partly because FLE2 does not include a notification option, partly because the system is not flexible enough to be a planning tool. You cannot work collaboratively and iteratively on the order of course contexts and the content of announcements and starting problems when everything you post automatically is arranged in reverse chronological order with no option to edit. Of course you can exchange messages with attachments or upload files to the Webtop for others to copy, but there is no convenient way to share documents. It would be well worth introducing options to revise and version documents in the manner of BSCW, on which FLE2 is based. Given the option to version documents would not compromise the FLE2 principle of total transparency of the work process.

Integration of the courses in the educational programmes

FLE2 has been designed as a computer-mediated superstructure to conventional classroom teaching. Thus the system is meant to be integrated into the daily work of the students. As mentioned, the test courses have been offered on par with conventional courses. But they have by no means been easy to integrate into the academic activities of the students. FLE2 is not to blame for the obstacles encountered, they are bound to occur whenever computer-mediated teaching is introduced in day school activities. But if systems such as FLE2 are to be an integrated part of campus life certain problems have to be solved.

In terms of *course planning* it has to be taken into account that time has to be allotted for technical instruction, and, depending on the type of course using FLE2, also to either an introduction to the pedagogical concepts or at least to some principles for using the categories-of-inquiry tags in a meaningful way. This process can in fact be quite time consuming, a couple of hours has proven to be insufficient. Time spent on introduction to the system has to be deducted from the total number of course work hours (determined by the credit system), and obviously this leaves less time for course content. It may be argued, however, that training the students in system use is a one off investment, certainly worthwhile if they are to use the same system on a regular basis for a number of years.

In terms of *student workload*, the courses have been quite demanding. A very common complaint has been that the credits given for the courses do not reflect the amount of work put into them. A better basic knowledge of the system probably would have reduced the work-load. But the work form definitely requires more of the student. Unlike most other courses where students may benefit in some way just by attending, in online work they must parti-

cipate actively to benefit at all, both reading the postings of others – quite a time consuming process – and contributing themselves.

Accessibilty has been a problem for some students. Not everyone has a computer with an internet-connection at home, and these unfortunates have had to fit online discussion into an often busy daytime schedule, competing with many others for a vacant machine in the computer labs. Those who do have a private internet-connection often run on fairly slow modem connections, and to them the sluggishness of FLE2 has been not just an annoyance but also an economic concern.

In short, apart from the novelty the groupware-supported courses have not been particularly attractive to the students in comparison with conventional courses with which they have to compete. In this competition our courses also fail because they require a form of study that does not fit in too well with the rhythm of day school activities. On-campus courses normally are run in parallel, meaning that students take a number of different courses within a certain time span, attending different classes on different days of the week. Students are able to compartmentalize their activities, fx spending Monday preparing for classes Tuesday, and Wednesday preparing for Thursday. The groupware-supported courses require sustained attention, and if you fail to participate for a few days it may become difficult to catch up. The online activities of course slow down and may become more superficial as a consequence of the probably inevitable divided attention of the students. In our experience with net based education it is a golden rule that things should be done in sequence rather than in parallel, one task or one discussion at a time. But this is simply not possible when you introduce net based courses as part of the day school programme.

Pedagogical issues

One of the main attractions of FLE2 is the classification of all postings into a "category of inquiry". The system of tagged messages is meant to provide a graphical overview of the progression of an inquiry from the first phase of formulating a problem until the final conclusion has been reached. However, the discussion thread with its labels does not truly graphically represent the stages of the progressive inquiry process (as outlined in Muukkonen, H; Hakkarainen K.; Leinonen T. 2000).

The system of tags is a tool for structuring work, and it certainly is a wonderful tool for analyzing a discussion once it has been completed. Provided, of course, that the content of the posting actually corresponds to the tag. In our experience, more often than not this has not been the case. A very simple reason for this is that messages rarely are so unambiguous that they can be fitted into one or another of the few available categories with any degree of ease. An even simpler explanation is that people often forget to choose a category, and once the message has been posted the default tag cannot be changed.

Practice and discipline may teach you to keep messages simple and directed. But if you choose to follow the path of FLE2 progressive inquiry you still have to make the tags correspond in some way with the various stages of inquiry. This has been a matter of some confusion, because there is a partial overlap in terminology between the terms for the stages and the names of the tags. Even if they are not supposed to be matched, the students tend to match the tag "Problem" with the inquiry stage called "Presenting Research Problems", the "Work" tag is associated with the working "Working Theory" stage and the "Deepening Knowledge" tag is identified with the either "Searching Deepening Knowledge" or "Developing Deepening Problems". But the subsequent stages of inquiry are not readily covered by the labels, and thus users became uncertain as to what label to choose. Quite often we have seen discussions deteriorate into a sequence of "comments". Categories used randomly would seem to be a barrier rather than a shortcut in the learning process.

In all collaborative work it is essential to establish a sense of social obligation among the participants. The best way of course is to have people meet to get to know one another. This did not happen with students from different universities in course 1 and 3, and predictably the spirit of cooperation between students from different institutions was not pronounced. In courses 2 and 4 the students got to know each other slightly better. But in all cases there was a need to establish identity within the FLE2 system. This can be done by adding a small picture (an operation that many students found difficult) and by filling in some rather matter-of-fact information in a personal fact sheet. More detailed personal introductions have to be made by requesting the students to post a CV and some anecdotal material in a course context devoted to presentations. Even if some students do take the time to add some personal information, having a "Personal presentations" course context is not particularly useful. In some cases such presentations have been used by the students in the process of forming groups, and it has been quite time consuming for them to navigate through a list of presentations. Typically, however, you need the information when you are discussing in a thread or looking at someone's Webtop, and in both cases the information is accessible only if you interrupt whatever you are doing, click your way to the presentations area and find the individual from the random-order postings containing presentations. More informative fact-sheets would be an obvious solution, and they should be accessible only one mouse click away.

One of the fine and much appreciated features of FLE2 is the list of course participants at the top of the KBE and Webtop screens. By the simple means of highlighting the names of those who are active on the system some sense of community can be created. Many people choose a nickname as a user name, and it would in fact be useful if there were an easy way to display proper names (fx a mouse-over function would do the trick). With many participants in the course the lists becomes a somewhat chaotic compact mass of names in random order, and some students have felt lonely and intimidated by looking at a great many unfamiliar names. But if you stick to about 15 participants, the optimum defined by the designers, the feature works just fine.

While the awareness feature is excellent for creating a sense of shared space, it gives you no indication of what the other users are doing. When it comes to cooperative work, which ought to be an important function in FLE2, users are left pretty much in the dark as to what the others are doing. You cannot establish when another user was last logged in, and you cannot see if others have read your postings. These are real shortcomings in group work, and it can make students feel very lonely while they are waiting for a response to a posting.

On a more general note we may add that because courses involving groupware are particularly demanding on the students, great care should be taken in preparing the students for what they are in for. Course descriptions must outline in detail: What is the purpose of the course? How will it be realized? What is the role of technology? What are the requirements (academic, effort, IT-skills, hardware/software)? And how are the students to meet them using the computer medium? You have to make it absolutely clear that the work form presupposes academic maturity in so far as each student must take responsibility for his or her own learning by participating actively and creatively on a constant basis.

Even if these preconditions are met, students are likely to be overwhelmed not just by work, but also by the complexity of the virtual environment. Without constant supervision they are likely to loose track, particularly if the course structure is deliberately vague in order to allow them to formulate and pursue their own research questions. If they loose the sense of purpose, progression and overview their motivation for using the groupware-system begins to fail, and once they neglect to catch up they are on their way to dropping out.

FLE2 interface and functionality

Our users have experienced several problems with the functionality of FLE2, many of them quite frustrating. Some are actual functional or usability problems, others are due to non-intuitive functionality. Problems of the latter kind could have been largely eliminated if FLE2 had been equipped with proper a online help function.

On the most general level, some of the critical remarks can be ascribed to the design of the student user interface in two major components, Webtop and Knowledge Building Environment (KBE, chat is a third component, subsidiary to KBE). At any given moment you will be using either one or the other, and it requires some effort to change mode: you have to change the focus of your attention, whatever you were doing will disappear from view, and – at least to the Danish students running on a Helsinki-server – there will be a response time of up to 18 seconds. The response time alone discourages too many excursions from KBE to individual Webtops. Clearly, a closer integration of the two main modules is desirable, preferably simultaneous display in different panels or windows.

It may be objected that means of integration exist, because it is possible to include links from a KBE posting to an object on the Webtop and vice versa. However, this is not an altogether straightforward operation: First you have to go to the Webtop in order to establish the URL of the object you wish to refer to and to and copy it. Then you must switch to the KBE and find the thread and location in the thread where you will be adding the link (the location is not "remembered" if you happened to be looking a posting in KBE before switching), and finally of course create a posting, pasting in the URL in the link field of the form. As is frequently the case with software, a simple workaround can be devised to deal with functionality problems. In this case the obvious solution is to open an extra FLE2 window. In fact in other situations as well an extra window may come in handy, fx. showing an overview of the course contexts while you are reading a posting or showing a posting while you are writing a reply.

In all four courses the Webtop has been used little. A simple technical reason, never quite explained, is that at a certain stage when using the FLE2 the system will start up in KBE, when you log in. It has been a common phenomenon, perhaps some kind of involuntary bookmarking, but the effect has been that people stay on in KBE where the action is.

More importantly, the Webtop has not been not terribly useful to the students. A major problem with FLE2 is that the system emphasizes individual contributions rather than work processes. It is all well and good that you are supposed to share knowledge by displaying evidence of your personal understanding on your Webtop. But the dynamics of the process and the real sharing is happening in KBE. If you can survey the process and the resulting shared understanding in KBE, and if you can attach files to posting for others to read and comment upon, why should you want to make the cumbersome journey to a lot of individual desktops displaying various fragments?

As an archive the Webtop may be useful. However, the total lack of privacy in effect might discourage use of the Webtop as a personal notebook – anyone can read anything on any Webtop.

One of the consequences of the reluctance to use the Webtop is that its most important feature, the Stickie person-to-person note system has been used little. Quite often, it will seem, messages have been overlooked for lengthy periods. However, the Stickie also suffers from usability problems because the feature only allows display of very short texts, but still allows the user to type at length. Most users have experienced frustration after typing in a message only to discover that all but the first few sentences has been lost.

The other built-in feature on the Webtop is the "news" panel displaying the number of supposedly unread messages in the system – as often as not the figure is not accurate. It

appears to be a wonderful tool for the instructor: It quite accurately informs you of the level of activity of each individual student. However, it does so only in terms of quantity, not quality. Many students have expressed misgivings about the feature: You log in (or more likely switch to the Webtop), and immediately the system hits you on the head – so much work to do to catch up, but where are these many messages, and what are they about?

Part of the answer is to be found on the opening screen of the Knowledge Building Environment. For each starting problem (thread) the title and subject tag of each unread message is displayed in reverse chronological order. If you have been away from a lively discussion for a few days you are likely to be confronted with a very long list, and it slows down the display of the KBE opening screen considerably. These lists are not very helpful, because if you choose to read the messages from the opening screen you are likely to miss the context of the postings. Thus the rational thing to do is to open the particular thread where you want to start. In the display of the individual thread the titles of unread postings are displayed in bold, and it is quite easy to get a sense of the development of the discussion.

In general, clutter is a problem in KBE. FLE2 adheres to the principle that the entire learning process must be permanently visible. This is a strength and a weakness. The strength is consistency and the possibility to document exactly what transactions have taken place – a feature most useful when it comes to analyzing the material. But for the regular student user, as a course develops, KBE becomes increasing bulky and difficult to survey, It would be a blessing if you could hide course contexts that are no longer important. A simple model is to be found in the display in Microsoft Pathfinder – copied in most conferencing systems – where you can expand and collapse the folder tree (containing files or messages). Such a feature would also solve the often mentioned complaint that the hierarchies of the course contexts and starting problems are difficult to survey and quite hard and time consuming to navigate, because you continually have to move from overview to the detailed view of the single thread.

Much energy has been expanded in criticizing another consequence of the principle of permanent visibility. Once a participant has posted a message, it is there for the duration of the course. It cannot be edited, it cannot be moved, and it cannot be deleted. There is a good technical reason for disallowing delete, because you when you delete a posting in a thread you may also delete all responses to the posting, thus destroying other people's work and perhaps also the meaning of the discussion. But people – or Danes at least - do not work that way. People make mistakes, quite many actually, given the poor functionality of the posting editor (see below), and they make statements at the spur of the moment and later wish they had not. The inflexibility of FLE2 in this respect not only annoys and demotivates the participants, it also does damage to the structure of the discussions, because you cannot even change the category-of-inquiry tag for a posting – a wrong choice of tag being one of the most common mistakes people make in the process of posting messages.

The FLE2 editor is a very simple one, a small panel where you can type plain text or HTML-code, no word processing features available. When opening the editor you are no longer able to see the message that you are responding to, nor can you see the thread that indicates the context. Both shortcomings are unfortunate. Also you have to make sure to choose the right category of inquiry tag before you post the message. If you do not, the system will choose a default for you ("problem"), a feature that has generated a lot of mistakes and angry comments and meta comments trying to set things straight. A preview function lets you see the message before committing it to the thread, but the feature is slightly buggy, adding your name and superfluous quotation marks each time you return to edit mode.

The graphical display of threads is one of the really fine features in FLE2, but again, an option to expand and collapse parts of the threads – for instance expanding/collapsing

responses to a particular posting – would make it much easier to survey the thread. Threads can be sorted in various useful ways, and this feature should be expanded to sorting also by date and title of the posting. In fact, adding an effective search engine would greatly improve the usefulness of the system.

Chat provides a good synchronous alternative to the threaded discussions, and it has been used in so far as the chat function has been working. Often it is quite useful for the students to be able to log a chat discussion for later use. No log function is available in the Ewgie chat room that is bundled with FLE2, but the students have developed a workaround by copying and pasting the text preserved in the computer memory before logging off.

Finally, in terms of aesthetics there is some room for improvement in the FLE2 interface, and indeed some of the problems have been addressed in the FLE3 user interface. Users were generally critical of colour scheme and icons – some remarking that they appeal to children rather than adults. It is an apt observation, since FLE2 seems to have been designed for use at all educational levels. It is not an easy task to design for several age groups at once – some items will be too abstract for children, other items will appear childish to adults and thus help undermine the credibility or attractiveness of the system.

Technical and administrative matters

The FLE2 experience has been marred with technical problems, and this has generated a generally sceptical attitude towards the system among the students participating in the test courses.

All four courses have been run on a Finnish server, and the performance of the system in Finland and Denmark has differed radically. Perhaps the problems experienced in Denmark should be ascribed to slow connections, but then other connections between Finland and Denmark usually are not particularly sluggish. Response times have been painfully slow. Some examples of average response times for routine actions measured in Denmark are:

Shift from Webtop to KBE: 18 seconds, shift from Webtop to another Webtop 20 seconds, shift from KBE overview to a particular thread 6.5 seconds, shift from the display of a particular posting to the KBE overview 17 seconds. These figures, compiled over a period of three days using ADSL 256 and 512 KB and 2 MB connections, have been suggested to be due to temporary server problems, but even when the system has been running somewhat better response times have been unacceptable.

In a system under development some bugs are to be expected and accepted. But basically the system ought to work. One bug in particular, though, has had a measurably effect on course work, as messages in several instances have been lost when the authors tried to post them. After witnessing a number of furious outbursts when long messages were lost, we eventually advised the students always to use a workaround by copying their text before posting or to write texts using a word processor and copy it to the FLE2-system.

Another unfortunate shortcoming occurred in course 4, when the Chat module ceased to function. The problem was never corrected, and we had to do without chat for the final three months of the project.

Support is an important part of any software-package. The FLE2 experiment has illustrated some of the problems involved in delivering/getting support when running a course on hardware hosted by a far-away institution and with no local software-support. Together we have had our share of slow communication, misunderstandings, linguistic problems, unannounced stops and changes etc. These are matters that can and should be corrected when the FLE project progresses from R&D-project to final product. They need to be mentioned

here, however, because they have in fact had some bearing on performance in the four experimental courses.

Summing up

In the plan for the FLE2 R&D-project 12 themes have been singled out for evaluation. By way of summary, let us look at them one at a time, changing our perspective from critical review to more constructive suggestions for improvement of the FLE-system.

1. "Are the users satisfied by the functionality provided by the system?"

On the previous pages we have listed a number of instances of problematic functionality. Some of them are largely technical matters that can be improved fairly simply. But on a more general level the issues of module integration and flexibility need to be addressed.

To the user the Knowledge Building Environment and the Webtop appear to be two separate modules with a minimum of integration – one for collaborative work, the other for personal use (but not private use). Even though learning in the final analysis must be individual, the process of creating knowledge is often collaborative, and the whole point in using groupware is to facilitate that process. The FLE2 design seems to place itself solidly between two chairs by emphasizing individual understanding (evidence of which is meant to be scattered over just so many Webtops) at the expense of collaborative work that is limited to conferencing (albeit with the option to include attachments). If FLE2 is to be the tool for problem-based work that it is meant to be, it will be worth discussing how the facilities for project work can be improved. A very simple solution would be to create additional "project Webtops" to serve as archives and collaborative workspaces for all participants. A more radical solution would be to develop the KBE so that course contexts will become mixed conferencing and archive environments. An important detail in such a structure would be to replace the Webtop Stickies with a well-functioning person-to-person messaging system, integrated in KBE.

Greater flexibility is needed if FLE2 is to be accepted as a tool for adult education. Of course the principle that the entire knowledge building experience must be permanent and transparent is a fine one. But it is also a barrier to system acceptance. There is good reason for disallowing deletion of messages, because it may destroy the threading, including other people's work. Still, editing should be allowed. As the very minimum, the author of a message should be allowed to change the category-of-inquiry tag. But why not allow editing either (and preferably) freely or within a certain interval that could be measured in time or context (eg. that a message may be edited as long as it has not been replied to)?

2. "How does FLE2 support current practices of learning and instruction at university?"

There are two facets to this question. One is the problem of integrating groupware-supported courses into conventional university life. This has already been discussed on the previous pages. The other facet is that of how system design functions in relation to preferred work forms of the institution.

Roskilde University joined the FLE2-project on the assumption that the suggested work form in FLE2 has a lot in common with the problem-oriented project work form that forms the basis of Roskilde University pedagogy. It might have been interesting to test FL2 as a system for group work support, but we ruled out the possibility partly because the project is meant to study formalized teaching in some form, partly because the system, as we tested it, allows only one administrator with all necessary privileges per course – and group members need to be peers. However, we wanted to introduce FLE2 into course work in order to stimulate

interest and activity by introducing a collaborative work form with which the students are familiar (at least the Danish students).

The results have nor been altogether encouraging, but FLE2 is not to blame for everything that went wrong. We have experimented with two situations: pure net based learning and classroom work supplemented with FLE2. In the first instance FLE2 is deemed to be adequate as a conferencing system even if functionality may be improved significantly. If you stick closely to the recommended use it may even help structure discussions. In the second instance the system seemed superfluous (and probably most systems would), at least to the students who would ask: if we are having discussions face-to-face in class, and if we can meet on a regular basis on campus, why then must we use a conferencing system when it does not facilitate our work? At times, we as instructors and evaluators felt that we had to cope with the old catchword: "Technology is the answer, but what is the question?" Rather than concluding that groupware in general and FLE2 in particular does not fit in, we would suggest that we have not been able to develop an adequate form of teaching. Much more pedagogical development work needs to be done on teaching in mixed environments.

3. Does the usage of the FLE2 system improve the quality and efficiency of the work of the users?

This is not an unambiguous question. First of all there is the question of technological overhead. It has been considerable in the four test courses. As mentioned above instruction in using the system may be considered a one-off investment, but it still has to be done at some stage. Deciding to introduce a system like FLE2 as a standard on campus is in fact a major decision

Secondly, we have noted that not all of our students are technically advanced. The technological "haves" may have experienced some positive effects, but the "have-nots" who had to spend time and effort struggling for available machines with internet connections, seem to have felt differently.

Thirdly, FLE2 has been marred with so many functionality and usability problems that it is difficult to answer the question. In case of the actual courses taught in 2000-2001 the answer to the question is plainly "no", but given a release version of a better-functioning FLE-system, the answer might be affirmative.

4. How easy is the system to use from the viewpoint of the students and teachers (user-friendliness)?

"User-friendlines" is taken to be synonymous with "usability", a classical definition of which is: easy to learn, easy to remember, few errors, efficient to use, subjectively pleasing (Nielsen 1993). On the whole the FLE2 system per se, even if moderately "user-friendly", can be improved:

Easy to learn. Introducing FLE2 to ICT-novices has in fact been a challenge, and some students never mastered routine functions like uploading a file or the more intellectual ones like choosing a proper type-of-inquiry tag. FLE2, though simpler than many other groupware systems is not intuitively easy to use. Therefore much would have been gained, if online help had been available (see issue no. 9 below)

Easy to remember. Once mastered the students have had no difficulty in using the FLE2-system, even after a break of some weeks.

Few errors. In this instance we are looking at errors due to functionality (not mistakes as discussed in issue 1). FLE2 has a fairly simple user interface that does not provoke critical

technical errors. Certain functions, however, do invite less serious errors, cases in point being writing Stickies or forgetting to choose a type-of-inquiry tag, both discussed above.

Efficient to use. Overall efficiency may be improved, examples mentioned on the previous pages being better integration between the various components (Webtop, KBE) and views of the discussions (eg. overview and detailed views in KBE),

Subjectively pleasing. It is always difficult to be specific about this criterion for usability, since there is no easy way to measure it. FLE2 has not been received with enthusiasm, and we have noticed that not a single student has been working on the material generated in FLE2 after meeting the requirements of his or her course.

5. What kind of support would the users need in order to be able to use the environment in an effective way?

The FLE2 prototype has offered only indirect support in the test period. We have been able to report bugs using a special form in the system. But no replies have been given. In addition a few faculty members have been corresponding with members of the development team. A final version of FLE could include an FAQ list, and some kind of hotline support certainly would be truly helpful.

6. For which type of applications is it [FLE2] particularly good?

This is a difficult question to answer, because several parameters outside the system must be taken into consideration: institutional teaching forms and pedagogical ideals, integration of groupware-supported courses in the total course plan, the qualifications and motivation of faculty and students, course structure and course content. In the four test courses we have experimented with different forms of teaching that we already practise or would like to practise at Roskilde University. FLE2 has served reasonably well as a discussion forum. But although the fundamental FLE concept of supplementing Real Life classroom work with an electronic conference is an interesting one that should be explored in more depth, it has not appealed to the majority of our students. This may well be a matter of conservatism, and more information may help change attitudes. An FLE manual ought to explain in some detail: what are the benefits of this particular work form, how should one go about it, and it would be helpful to provide some demo courses or at least some descriptions of successful FLE courses.

7. Which extensions or enhancements might be required to extend its application area?

This has already been discussed in the review of the test courses, important points being shared archives and private archives, awareness of what others have been doing, a better person-to-person messaging function, a chat that can be logged, an improved and more elaborate function for making personal presentations, improved facilities for editing, a search engine within FLE, a function to expand or collapse discussion threads. In general, empowerment of students and faculty could be wished for, both in terms of what they are allowed to do and how they wish to organize their work.

8. Required resources for installation and maintenance, robustness, performance

At Roskilde University we have not had the opportunity to install FLE2 on our own server. Thus we cannot evaluate requirements for installation and maintenance. In terms of robustness and performance we have also been at a disadvantage, because when working from Denmark on a Finnish server we have not been able to estimate if the very real problems encountered should be ascribed to the system or to the internet connection. However, the exercise has been useful in establishing that the setup using a foreign host has not been

optimal, and that if the FLE-organization considers hosting institutional use on, say a Nordic or European basis, the robustness and performance of FLE need to be considered.

9. Quality of documentation

The brief instruction manual for FLE2 is adequate for getting users up and running. As discussed in issues 3 and 6 above, written documentation should also include chapters on recommended use, and online help and FAQs are considered essential to successful use.

10. The pedagogical outcomes such as the general mediation of skills and knowledge among the members of the learning community

The evaluation reports from the CBS LearningLab discuss this question in great detail, and the most positive thing they have to say is that our students have gained hands-on experience in using a groupware system and have developed notions on how to evaluate such systems. In terms of course content, however, the impression is that learning might have been more efficient had we chosen more conventional forms of teaching. Again, several factors must be considered: course form, course planning and coordination, pedagogy, the technical overhead, the integration of time consuming courses into the regular schedule, the qualifications of faculty and students.

An interesting hypothesis presented by the evaluators is that the courses would have worked much better if we had adhered strictly to the FLE2 pedagogy. It might be objected that course no. 1 actually did just that and was not significantly more successful than courses nos. 3 and 4. Still, the fundamental problem raised is that of applicability. All educational software is constructed on the basis of – often implicit – cultural and pedagogical norms, which is why eg. highly structured American e-learning tools are not particularly suitable in a constructivist environment like the one we have at Roskilde University.

FLE2 is noteworthy for its highly conscious and very explicit application of a particular pedagogical theory. The aim of the tests at Roskilde University has been to establish whether FLE2 is suitable for a more general use, and if we are to accept the criticism advanced by the evaluators the answer is "no, not in the present form". We are not sure, however, that the answers should be all black-and-white. We have in fact been able to use FLE2 in a context different from the R&D environment in Helsinki, and the series of tests has been a learning process also for the faculty involved. So probably we would be able to adapt future courses to make more effective use of FLE2.

11. The use of tools for searching information, representing ideas and modelling expert-like interaction

FLE2 does include a "library", but it contains only a collection of literature on education, and it has not been used much. Information searches have had to be made outside the system, which is of course that most rational thing to do. A search facility with the FLE2 would have been extremely useful, preferably one allowing free text searches. The KBE is designed to be a tool for modelling expert-like interaction, but as discussed above we have not been successful in using it as such.

12. The tutors' ability to provide guidance and support

FLE2 seems to be very much a teacher's tool. You can easily monitor the efforts of the students, quantitatively at least, and the category-of-inquiry tags in theory make it easy to survey, and later analyse, a discussion and find postings that need to be commented on. Working with FLE2 as a tutor has been a positive experience from the point of view of guidance. However, it would have been extremely useful to have a tool for communicating privately with individual students. Certain comments are better made outside the public space

of KBE and stickies, some have been made by e-mail outside the system, and something has had to pass unsaid.

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