Wallenberg global learning network

Achievement report academic year 2000/2001

Content

Executive summary

The founding documents of the Wallenberg Global Learning Network (WGLN) express three common objectives in research into computer-supported education. First, WGLN operations will be based on shared projects that emphasize evaluation and specific deliverables. Second, the network will create a community of expertise by facilitating global faculty and student interaction, global teams and visiting scholars. Finally, WGLN will build a common infrastructure for global co-operation and knowledge transfer.

Project achievements

Over the last year, WGLN projects have begun to yield exciting results, increasing our knowledge about computer-supported learning and teaching in a global network and producing tools and technologies for new pedagogic approaches. Some of the WGLN projects have come to completion during the year, others are progressing on schedule and are even building new goals on the basis of their results. Results from the WGLN projects, briefly presented in this report, include advances in building prototypes, innovations in curriculum design, and the production of knowledge about Information and Communication Technologies (ICT) in a global educational context. Projects have:

- Creatively adapted and developed software to make virtual classrooms truly sharable spaces.
- Designed and demonstrated a prototype for a global course with on-line lectures and exercises.
- Developed patient cases as a model for case-based learning.
- Produced insights into the learning opportunities posed by globally dispersed teams.
- Created a highly interactive simulated virtual learning environment in a global course with students and faculty at three universities in the United States and Sweden.
- Documented innovative curricular design and demonstrated opportunities for global co-operation.
- Amassed data on student perceptions and uses of technology in the physical and virtual classroom.

In addition, it should be noted that several of the prototypes developed have begun to show that they can be useful in educational contexts beyond the particular disciplines for which they were developed. This move toward generalizable results is crucial.

The WGLN community and infrastructure

Considerable progress in WGLN's organizational development has also been made. Our co-operative efforts have produced what we believe are solutions to many of the challenges we faced this time last year. The partners in the network have agreed on a set of governing documents for WGLN organizational and financial issues.

All WGLN partners have approved a policy for intellectual property rights. Principles and practices for project evaluation have been agreed upon and made accessible on the web; they will be fully implemented in next year's WGLN projects.

Summit meetings for the Technology and Evaluation Teams, as well as three major WGLN Faculty Workshops on key themes, have helped to bring the research projects and strategies at the different labs in line with one another. We have successfully developed and put in place a procedure for project evaluation, and are developing a technical infrastructure available to all project participants and staff. We have a high quality point-to-point video conferencing tool and a WGLN web and graphic profile with source information about WGLN and the projects to help promote interaction between faculty, students and staff. Besides facilitating information, communication and documentation and making a place for the WGLN community, the evaluation practice, video conferencing infrastructure and web site both consolidates a base for knowledge about ICT and education gained in the collaborative projects, and helps disseminate that knowledge. These achievements have been instrumental to the development of a sense of identity and community among WGLN partners—a sense of shared vision and common goals.

Conclusion

As the WGLN enters into its third year, the spreading of information about the network, documenting learning lab projects, and disseminating experimental results through conference papers, workshops, and publications have gained in importance. Having succeeded in clearly defining the network's research areas and the policies and procedures necessary for our common efforts, the main challenge for the projects will be to formulate and document new insights on learning. The main challenge for the network will be to consolidate its output channels and to expand its community of faculty.

WGLN chairman | Stig Hagström

WGLN managing director | Gunnar Backman

Project reports

DILS: Distributed Interactive Learning Spaces

The three DILS projects described here, running for the first half of 2000, have focused on different aspects of physical and virtual spaces for learning with IT. The DILS projects ended according to plan on June 30, 2001. Two of the projects, however, will be folded into new WGLN projects, Mobile Learners and Ispace.

DILS track A - Communications Systems Design Experiment

Design and implementation of scalable courses

Project aims and methods

The project "Design and Implementation of Scalable Courses" has investigated the effect of web technology and networking on learning, course design, and course size. Can the innovative and pedagogical use of IT allow more students to take a course without changing the number of teachers or the quality of learning? Can student-to-student learning, with the right mix of technical and spatial support, help reduce the level of student-teacher interaction required for high-quality learning outcomes? These questions were examined in an advanced course in computer communications systems design for students at the Royal Institute of Technology (KTH) in Sweden and at Stanford University. Teachers at KTH and SU designed online learning material and conducted telelectures. Teaching assistants, or coaches, sponsored by businesses, facilitated peer group learning activities, including videoconferencing. While corporate sponsors invested primarily in course equipment, WGLN sponsored the innovative curriculum design as well as data collection and analysis. During the course, data was collected, primarily through interviews, on time investment, funding, and the perceived quality of the learning and teaching experiences.

Results

Courses are scalable given the model of commercial sponsorship of teaching assistants found in this course. The model generates further questions, however, about its capacity: What are the limits on expanding sponsorship for student groups and/or for specialist equipment? How can a sufficient number of qualified and motivated teaching assistants be found, especially given the difficulty of keeping good graduate students when industry salaries are high? The teaching model also raises the issue of how best to preserve academic integrity in commercially sponsored university courses: What role should sponsors play in defining course projects or influencing course content? Is academic integrity jeopardized when sponsors grade student performance?

Developing web-based information sources requires high investments in time and money, at least initially. Senior teaching staff felt that the investment would pay off when materials and methods were reused and refined. Students emphasized the combined importance of teaching assistants and equipment such as portable computers, web support, and online learning material.

This project indicates that further investigation into the financial and time costs associated with computer-based teaching and learning resources is necessary. Strategies or routines for reliable time logging—for teachers, coaches, and students—will help determine the relationship between the information collected in interviews and the actual time spent on course-related tasks. Reported time allocations are often known to vary significantly from those obtained by logging activity via timesheets.
The actual use and the perceived value of types of on-line resources also deserve further attention. This can be done using web-logging to track resource accessing and to compile statistics on the time distribution of accessing and the percentage of a class that accesses each type of on-line resource. Data collection and analysis of this type can help determine effective ways of structuring information and providing intuitive access to information via computers.

For a detailed discussion of the results of this DILS experiment, see "Implementing Scalable Course Environments" by A. N. Pears at http://www.docs.uu.se/~ARNOLDP/Research/DILS/Scalability/

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collaborative partners	Royal Institute of Technology Stanford University

DILS track B - Interactive Communicative Learning Spaces

Project aims and methods

This DILS project is conducting a longitudinal study into the design, creation, and evaluation of physical and virtual learning spaces for interactive pedagogical methods. The focus of the study is on the complex concept of "quality of communication," which will be further examined in the planned follow-up project, iSpaces.
The educational and physical context for this long-term study is the Media Technology Program at the Royal Institute of Technology. The *provisorium* phase of the project, involving small-scale experiments, focuses on research questions in the context of two MT courses, "Communicative Spaces" and "Telepresence Production." The latter course involves technologies for distance teaching, since it is run in cooperation with Gövik College in Norway. Guiding research questions are:

- How can physical learning space be organized and designed to allow for and support a multitude of simultaneous learning modes as well as the rapid and flexible transformation of space between different modes?
- How can such a physical learning space be extended into virtual space to allow for both synchronous and asynchronous participation at a distance?

The primary pedagogical questions related to the design solutions are:

- Can learning processes and learning outcome be improved through space design and ICT support?
- Can team building and collaborative learning be reinforced through flexible physical and virtual space design and a mix of modes in local and distributed work?
- Is student motivation, engagement, and satisfaction promoted by flexible space design with support for different learning modes?
- Can flexible communicative spaces support improved educational quality at a lower or equal total cost?

Results

A learning space for the Media Technology Program has been designed and equipped. The learning environment, accessible to students round the clock, has been used in most of the required courses. The "Communicative Spaces" course has carried out a spatial design analysis, and virtual extensions and collaborative distance work have been tested in "Telepresence Production."

The space and its equipment were successfully tested during the European Union Summit in Stockholm in March 2001. The KTH was connected with Stockholm City Hall during an official event. Results of student evaluation of the environment and the learning project indicate a need for flexible design, so that learning is not disturbed by simultaneous uses of the space. Students have also identified a need to know more about operating telepresence equipment.

Project experiences in spaces for learning has been documented and presented at international conferences (e.g., the European Graphic/Media Industry Network conference in Madrid, Spain, March 15-16, 2001), and published in the following reports:

Enlund, N.: ”The production of presence — distance techniques in education, publishing and art”, *ACS'2000 Proceedings*, Szczecin, 2000, pp. 44-49.

Sponberg, H., Knudsen, C.J., Handberg, L.: ”New learning modes in the production of presence — distance techniques for education*”*, *Proceedings of the 20th ICDE World Conference on Open Learning and Distance Education*, Düsseldorf, 2001.

Enlund, N.: ”Being virtually there — reality and presence in mediated learning”, *Proceedings of the 2001 International Conference on Telecommunications for Education and Training*, Charles University, Prague, 2001, pp. iv-ix (invited keynote lecture).

Knudsen, C.: ”Synchronous virtual spaces — transparent technology for producing a sense of presence at a distance”, *Proceedings of the 2001 International Conference on Telecommunications for Education and Training*, Charles University, Prague, 2001, pp. 145-150.

This DILS project has not yet been running long enough to produce conclusive answers to the questions it asks. The project has, however, produced a plan for extending research into a second, *laboratorium* phase. The larger scale experiments undertaken during this phase will be conducted at the new KTH library, scheduled for completion early in 2002.

principal investigator	Nils Enlund, Royal Institute of Technology
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DILS tack C - Distributed Interactive Project Team Experiment

Project aims and methods

The Distributed Interactive Project Team Experiment has focused on pedagogical issues of team co-operation over distance using ICT. Set in the globally distributed context of a course in Advanced Mechatronics at the Royal Institute of Technology in Sweden and a course in Team-Based Design Development with Corporate Partners at Stanford University, project efforts have concentrated on the following questions:

1. Does collaborative learning in globally distributed teams reinforce individual student self-confidence, motivation, engagement and emotional satisfaction?
2. Can excellence in learning be reinforced by collaborative work in globally distributed teams?
3. Can technology replace physical meetings between people? Can travel be reduced?
4. Can technology support offer students high quality educational activities in an individual and team based way without increasing total cost?

Building on a previous DILS-experiment, ”The impact of distributed project teams on learning excellence,” this second experiment with two student teams was begun during the 2000/2001 academic year. The student project undertaken under the auspices of the course is called “Project Company C.”

Results

The primary results from the experiment consist of a greater knowledge in the area of distributed and interactive collaborative teams in an educational setting. These results are reported in detail in “The Challenge of Distance: Opportunity Learning in Transnational Collaborative Educational Settings” (http://www.md.kth.se/~marting/the_challenge.htm).
The results suggest that what is commonly known as a difficulty or a drawback in working in global teams is often, in fact, a unique educational opportunity. Mixed personal, cultural, and institutional backgrounds for team members require a breadth of knowledge from students and place strong demands on students’ ability to understand, communicate, explain, and argue for specific solutions. While technology makes this possible, technology also fails at times. Technical difficulties created opportunities for creative student problem-solving that approaches real working situations in today’s multinational companies. The international, collaborative teams at KTH spent more time than other teams in critical discussions of subjects central to the course.

The results from the experiment show the following effects of globally distributed teamwork:
Disciplinary learning increases, primarily when a problem-based approach is used, due in part to greater access to technical resources but also to failures of technology.

The students improve their awareness of and benefit from cultural differences.
Student motivation is enhanced by the challenge of working in an international group and also due to the competition between the two teams.
The students gain greatly from comparing different educational systems.
The students become prepared for work in an internationally distributed fashion, which may be an important career asset.

More traditional difficulties such as distance in time and place also produce unique opportunities for team-building practices. The experiments show that the technology is approaching maturity where students are able to use technology for communication in a fruitful way. The question of scalability has been prioritized in the choice of equipment and communication strategy, and therefore the lesson learned is to downplay the technology-side and focus on commercial low-budget and freeware-solutions to enable scalability.

The two phases of DILS are documented in three reports:
The Mechatronics Experiment. A Preliminary report of Phase 1. *http://www.md.kth.se/~marting/mechatronicsexp.htm*
The Mechatronics Experiment, intro phase 2 *http://www.md.kth.se/~marting/*MME310_introphase2.htm
The Challenge of Distance: Opportunity Learning in Transnational Collaborative Educational Settings. This report consists of parts of an article written jointly by the assessment-teams at SLL and KTH-LL combined with results from The Mechatronics Experiment, Phase 2. *http://www.md.kth.se/~marting/the_challenge.htm*

principal investigator	Mats Hanson, Royal Institute of Technology
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Bioinformatics - Learning in Information Intense, Dynamic and Cross Disciplinary Environments

Project aims and methods

The Bioinformatics project investigates the efficiency of different learning situations in fast evolving, interdisciplinary research areas. Bioinformatics is such a discipline, bridging biology, medicine, mathematics, and computer science. Using well-defined experiments set in courses given at UU and KI, the project aims to develop and present cross-disciplinary educational material in the form of web-based modules and to examine how to best incorporate these modules into different infrastructures. The project also examines how thoroughly students integrate the disciplines involved in bioinformatics and how such integration can be promoted in the future. Information on the courses used as test-beds at UU and KI is available at *http://linnaeus.bmc.uu.se/wgln_bioinfo.html*.

Results

1. An important result of the project has been the development of a large set of preliminary modules in the areas of bioinformatics related to genome analysis, such as Biological databases, Genome assembly, Genome analysis, Phylogeny, Gene expression, Metabolic networks, Protein sequence information, Structure prediction and Proteomics. Students in media have designed a common interface for the modules and the modules completed so far have been placed under this general design. *See, for example: http://web1.ebc.uu.se/molev/swell/modules/biodata_mod1.html and http://web1.ebc.uu.se/molev/swell/modules/modules_1/ex/blast/index.html*.

The first set of course modules was implemented in on-site courses at Uppsala University (http://linnaeus.bmc.uu.se/course/bioinfo/) and Karolinska Institute as well as in a national on-line course (*http://linnaeus.bmc.uu.se/course/distance/*) during the fall of 2000.

A second set of course modules was created during the spring of 2001 and implemented during an on-line course (*http://linnaeus.bmc.uu.se/course/sommar/*) given during the summer of 2001 with teachers from Uppsala University and Karolinska Institute. In this course we used a new platform for web-based learning, Ping Pong *(http://wbl.uu.se/)*

2. Project activities have produced a prototype global course, with on-line lectures and exercises. This course is open to the public. The global course was a result of broadening the perspectives of the project by initiating contacts with Stanford University (USA), National University of Singapore (Singapore), University of Sydney (Australia), and University of Western Cape (SouthAfrica). Our attempt to establish a global alliance for the development of courses, tools, and infrastructures for bioinformatics education was reported in *Nature* (*Nature* 2001, 411:513).

3. A new evaluation-based learning model was jointly developed by the faculty and members of the assessment team in response to previous experimental results. The model encourages students to play an active role in evaluating and redesigning their learning environment to meet their individual needs and limitations. Students and teachers worked together to enhance comprehension of important concepts that on-line evaluation schemes and exam results showed to be imperfectly understood. The aim was to improve student understanding as well as the learning environment for next year's students. The students sought to enhance understanding by designing new pages for the web-book that presented the content in what they considered to be a better manner. This method of learning is reciprocal in the sense that the teachers guide students in response to individual student needs, and the students then guide the teachers in designing a learning environment that fulfills these individual needs. The students' contributions will be tested in the courses to be given during the fall of 2001. An example of student-designed pages for the web-page can be found at: *http://web1.ebc.uu.se/molev/student/sara/index.html*.

The new pedagogic model is described in a paper that was presented at the first European Conference on Computer-Supported Collaborative Learning in Maastricht, March 2001 *(http://www.mmi.unimaas.nl/euro-cscl/)*.

This model is of particular relevance for learning in information intense and cross-disciplinary environments. In such fields there is a tendency for lecturers to teach their specialised fields in a manner that is optimal for students within that area, but not necessarily for students with other academic backgrounds. We believe that a reciprocal, evaluation-based collaborative learning scheme will solve part of this problem by stimulating communication across disciplines and fostering integration of the sub-disciplines in a learning-productive manner.

4. Publicity and project results have been generated and disseminated in several forms:

- Oral presentations in meetings at Uppsala and Stockholm.
- Oral presentation at the European Conference on Computer-Supported collaborative Learning in Maastricht, March 2001 *(http://www.mmi.unimaas.nl/euro-cscl/)*.
- A report in *Nature* about our attempts to create a global alliance for bioinformatics education, May 2001 (Nature 2001, 411:513)
- The organization of an international workshop on bionformatics education, WEB01, July -01 (http://surya.bic.nus.edu.sg/web01/)

Overall, the project has progressed as planned. Some problems have been caused by difficulties in accessing data at KI and by lack of funding from the Stanford Learning Lab. However, project plans for the July-December period are exciting. Based on our new pedagogic model and the new web-based course material created by the teachers and the student we are now planning for a new set of experiments to be conducted during the fall of 2001. Novel material for the web-book will be designed and old material will be redesigned and edited on the basis of the feedback provided and the prototypes for modified web-based resources developed by the students. An in-depth assessment will be performed during the fall of 2001. A full paper describing the results of two years project of experimentation will be written.

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collaborative partners	Karolinska Institutet Uppsala University Stanford University

APE track A - Content and Context of Mathematics in Engineering Education

Project aims and methods

The goal of track A is to encourage and evaluate student use of various methods and techniques for knowledge management, particularly conceptual modelling and e-folios. Producing concept maps is a way of organizing information that may enhance learning. E-folios can be used to store concept maps, as well as accomplished tasks, assignments, notes, etc. The guiding research question for the two studies that make up Track A is if these tools and the skills their use employs can enhance the learning experience.

APE project comprises in two studies

Study 1: *Modeling of conceptual development in mathematics in the Information Technology Program at KTH*, which focuses on university students' perceptions of key conceptual structures in high school and college math.

Study 2: *Reflection on the curriculum, by the use of portfolios (e-folios), of the Media Technology Program at KTH with focus on mathematics*, which focuses on teaching goals in relation to learning outcomes and the role of reflection in learning.

Results study 1

Crucial work during the fall of 2000 was conducted on constructing, archiving, and interacting with Mathematical Resource Components. These components use existing programs to illustrate mathematical concepts and relationships. Some have been transformed into interactive web graphics and into CyberMath, the learning environment created in APE Track C. Licenses have been acquired for the Graphing Calculator at KTH, which offers truly novel ways to interact with the components of a mathematics archive, where frozen animations can be downloaded and easily manipulated by users.

Maps of three different concepts have been constructed by the 150 students in the IT Program, working in groups over an entire year. The maps have been collected, and those from the fall term have been systematically encoded. Encoding will make it possible to investigate a variety of correlations between different conceptualizations. Encoding of maps produced during the spring term is underway.

Project results and experiences have been presented in national and international conferences. The Conzilla program was presented in Washington DC on October 28 at the CILT-2000 learning conference. A report from this conference can be found on http://www.learninglab.kth.se/library/presentations
The Conzilla program was also invited for a special presentation at a workshop on modelling and visualization in Washington DC on October 25 arranged by EdGrid and National Center for Super-computing Applications in connection with the CILT-2000 conference (see www.eot.org/edgrid/mvworkshop.html).

Presentations from the spring of 2000 are:
K2Lab conference, Åre, 19/2-2001
KTH Learning Lab, seminar 10/1 - 2001
Uppsala Learning Lab, seminar 21/3 - 2001
International Conference on open learning and Distance Education (ICDE) Düsseldorf, 3/4 - 2001.
Högskolan i Gövik, Norway, telepresence mediated presentation, 3/5 – 2001.
Luleå Technical University, seminar on mathematical didactics, 7/5 – 2001.
Mitthögskolan Östersund, e-Learning conference, 16/5-2001.
WGLN workshop on performance learning, KTH, 18/6 - 2001

In sum, the project has made excellent progress in its first eighteen months, and outcomes have already exceeded expectations. These results form an important part of the base for the planned continuation of our project. In fact, they have been crucial in creating a formal continuation of the project as the sub module "Personalised Mathematical Courselets" within the PADLR-project (Personalized Access to Distributed Learning Resources).

Results study 2

The APE study, involving students in the Media Technology Program at KTH, has continued the work of promoting student reflection on the learning process. The study has found that in spite of interest in e-folios and understanding of the principles behind their construction, few students have begun working of e-folios. Students reflect in different ways, with different tools, and to different extents.

The study has also charted differences in skills and experience with making html-pages. Strategies for acquiring skills vary as well, with some students taking an active, and some a passive, role in skill acquisition. Because of varying degrees of skill, students need an introductory course in computers and html. An important outcome of this last project period has been the development of plans for the WGLN project, "Folio thinking."

principle investigators	Study 1 Calle Jansson, Royal Institute of Technology Ambjörn Naeve, Royal Institute of Technology Study 2 Leif Handberg, Royal Institute of Technology
collaborative partners	Dept. of Computer and System Sciences Royal Institute of Technology Center for User Oriented IT Design NADA

APE track B - DRHum - Digital Resources in the Humanities

This project covers a large number of experiments and co-operative efforts in IT and the humanities.

Project aims and methods

The main goal of the project is to explore how digital resources in the humanities are best introduced into existing course structures, and how they can be made reusable so that they can be shared among courses and departments, thereby saving valuable teacher time and facilitating cross-disciplinary cooperation in university education. Other goals are to encourage teachers and students to combine material from different sources into their own learning environment, to exchange points of view, and to add their own contributions. Since digital material is only sparingly used in most humanities courses, the experiments done in the project will be exploratory in character.

Guiding research questions for educational aims in the humanities are:
1a How can computerized tests and exams in language education be combined with existing digital resources to provide support for individualized learning, by adapting the level, character, amount and order of the presented material to the student's proficiency level (as seen in her test results and/or teacher's comments and recommendations) and learning style?
1b Further, how can (a) test grading and (b) recommendations, based on test results, for self-study course, exercise, reading, etc. materials, be at least partly automated?
2a Which design principles are eligible in the organization of source archives in the humanities in order to make them accessible from different perspectives according to various needs and previous knowledge?
2b What kind of support will ameliorate teachers' and students' opportunities to share and collaborate on digital resources in history, literature and language education?
3 How do different navigational and filtering tools contribute to the students' capacity to work with digital resources and to relate them to material in their personal electronic portfolios?

Results

Work is underway on a tool for on-line diagnostic testing with individualized feedback, the Digital Interactive Diagnostic Administering and Correction System – Didax. A prototype was ready and presented at a Uppsala Learning Lab seminar in March 2001, as well as at the *20th World Conference on Open Learning and Distance Education*, Düsseldorf, 1–5 April 2001. Live testing has been delayed, but the test bed for this tool will be language courses in Russian and Spanish. The reactions of professionals to presentations of Didax at international conferences have been positive, particularly as regards computerized testing as a tool for teacher use, rather than a substitute for the teacher.

In collaboration with the LingoNet project, an infrastructure for digital language learning resources—including diagnostic tests—is being developed and tested.

In collaboration with the Squirrel project, the suitability of proposed e-learning standards for intelligent computer-assisted language learning is investigated.

A prototype e-folio system has been developed in a joint endeavor between the ULL e-folio project and DRHum. For two consecutive semesters, students of education at Uppsala University, in one of their courses—"Learning and ICT", have developed prototypes for their personalized digital portfolios on the Web, using a number of software tools with the assistance of a professional web designer. The process of working with the portfolios and the finished portfolios constituted the basis for assessment of the students (i.e., no exams or tests were administered). This was evaluated through a survey during the course. According to the survey, the portfolios were a success, and there were many insightful comments by the students about the ways in which awareness about the learning process (as well as motivation) was raised, and learning enhanced in the work with the portfolios. On the negative side, students remarked that they would have wished for more instruction in portfolio thinking and more supervision. A full report is under preparation by and will be published in the project report series later this year.

At the Dept. of Teacher Education, DRHum activities have focused mainly on four projects:

1. An ongoing work on building a database about women in Stockholm in the 19th and beginning 20th century. The database is a part of a larger historical project, and depends on the progress in other parts. A lot of work has been spent on gathering and structuring the complex biographical data that later will be organized in the database. A prototype for the database will be ready within approximately a year.
2. An archive of texts for studies in the social sciences has been organized. These texts are used in courses in education.
3. Developing a system for distribution of information about classes and lectures to all students. A database has been built in order to facilitate the information about classes and lectures as well as to distribute texts, comments, questions, working tasks etc. to be used during seminars. The aim is to facilitate the distribution, but especially to increase the accessibility for students, and to give them better chances to use their time efficiently. The system has been developed and is being tried out.
4. Used a number of platforms with a group of students in order to see how their digital portfolio work best can be supported (see above). By trying this out in a small scale, we feel better prepared to introduce digital portfolios to about 100 students in the next semester. The intention is to let the students use the portfolios for several years, in order not only to gather information and texts during a few limited courses, but also to help them prepare a larger major thesis at the end of their time at the university.

In the Dept. of History, e-folio solutions are being actively tried out, and faculty is encouraged to make some part of every course web-based. Finally, project results and experiences have been disseminated in the form of Learning Lab workshops/ seminars (March 2001; June 2001), conference presentations and publications (Distum workshop on IT in higher language education in Sweden, Sundsvall 5-6 Feb. 2001; the *20th World Conference on Open Learning and Distance Education*, Düsseldorf, 1–5 April 2001; the 12th Nordic Conference on Computational Linguistics (Nodalida'01), Uppsala, 21–22 May, 2001, and the *ALTE European Year of Languages Conference – Language Testing Issues in a Global Context*, Barcelona, 5–7 July 2001.: Lars Borin, Karine Åkerman Sarkisian, Camilla Bengtsson, Monica Langerth–Zetterman: "Developing and evaluating web-based diagnostic testing in university language education"), and working papers (DRHum Research Reports).

Ten to twently DRHumR titles are planned for 2001. In addition, faculty involved in DRHum projects have visited four Finnish centers for research and development on ICT in higher education, in order to discuss issues of common interest, with a view to possible future collaboration.

In sum, the results of the DRHum project need to be viewed in the context of the wide distribution of projects and of funds. The DRHum project came into existence because it was deemed desirable to bring the humanities into Learning Lab initiatives, otherwise the dominion of the natural sciences and technology. The DRHum project—being the only humanities Learning Lab project—thus encompasses a number of different disciplines: teacher education, languages/linguistics, history, and ALM/aesthetics/cultural studies. Each discipline accounts for a quite small amount of funding, allowing for only modest amounts of time to be set aside for work in the project (typically half a day or less per week). Systems development has been done by students, who have turned out to be inexpensive and still very knowledgeable—even if inexperienced—programmers and systems developers. They see this kind of job as a good experience, but their first priority is always getting finished with their education and getting a real job. Hence, they allow good work to be accomplished even on a tight budget, but they tend to be ephemeral.

Against this background, and keeping in mind the diversity of the DRHum project, we have not done at all badly; especially the group in the Department of Teacher Education and those involved in the development of Didax have generated some interesting results already.

principal investigators	Lars Borin, Uppsala University Jonas Gustafsson, Uppsala University
collaborative partners	Dept. of Slavic Languages and Dept. of Romance Languages, Uppsala Universtiy Dept. of Cultural Studies and Library & information science Uppsala Learning Lab, e-folio project Stanford Learning Lab, IRITE project Dept. of Teacher Training, Uppsala University Dept. of Linguistics, Uppsala University Dept. of History, Uppsala University Swedish Learning Lab, ISP project LingoNet project Squirrel project

APE, track C - 3D Communication and Visualization Environments for Learning - CVEL

Project aims and methods

Overall project goals are to increase and improve: students' ability to understand complex spatial and dynamic relationships in a variety of disciplines; possibilities for collaborative interaction between students and shared exploration of course contents from remote teaching settings; the ability to access and retrieve course material by visually exploring digital content archives. Experimental research focuses on the impact of 3D experiences on the learning process. What impact does instructional support such as a shared experience and/or mentoring by peers and teachers in a 3D environment have on learning? What impact does the pedagogical support built into tools such as interactive 3D objects and shared 3D environments have?

Results for DIS/UU

Following the completion of course-specific 3D content, the project has worked to improve and stabilize the generic features of the software developed, **Re**sponsive **E**nvironment for **Re**mot**e** **L**earning – **2ReeL**. More functional and general software will enable real classroom experiments. The ultimate goal of this software development is to provide teachers with an author-ware system for custom design of net-based educational settings.

The results of a user study of CyberMath has helped direct project efforts, allowing for problem identification and solution. For example, the problem of viewing coherency—allowing everyone in the 3D environment to share the exact same viewpoint—was solved by creating a "gather" command which facilitates teaching. Creating a function allowing one avatar to "fly" to a dialogue partner solved the problem of user preference for face-to-face interaction, even in a virtual environment.

Another advance in making 2Reel more universally applicable was the incorporation of OpenH323 libraries into **2ReeL**. These open source libraries, which can be found free of charge on the net (www.openh232.org), support voice communication standards and video conferencing, with different protocols allowing new degrees of flexibility to the responsive learning environment.

The purpose of the 2ReeL-server is to maintain and propagate shared simulation states such as, e.g.

- Whiteboard content and state
- Text chat messages
- Avatar positions and features
- Simulation states for the experiments
- Shared pointers
- Shared slide show content

The creation of a demonstration application for use in dental education has clearly demonstrated that CVEL tools, in particular 2ReeL, are usable as generic education tools across many other disciplines than just mathematics or computer science.
This dental demonstration system was shown at two conferences in the form of a 5-minute live-demo without any technical complications. Both demonstrations were appreciated by the medical and dental community, and they also showed that 2ReeL tools are maturing and are reliable and efficient enough for live demonstration within the tight presentation schedule of international conferences.

Results for CID/NADA

Improvements in the 3D, shared, virtual-reality-based mathematical learning environment called CyberMath have been made on the basis of user feedback. Improvements cover 1) the interface for controlling animations, 2) the transformation hall for studying transformations from 2D to 3D, 3) the appearance and functionality of avatars.

The CyberMath system, built on top of a VR-system called DIVE, shares some of the inherent weaknesses of the DIVE platform, which users have identified. In February 2001, CID therefore decided to develop a more powerful and flexible platform called WASA. WASA will be more robust and easier to use by teachers in real educational settings. This project aim is to develop a pedagogical framework, including teaching strategies, for using mixed-reality technology to implement techniques that support question-based-learning. Advantages of WASA will be:

- A set of open source programming libraries for graphically intense applications**.**
- More flexible scene graphics management.
- A roust, extendable feature set.
- Support for application–driven development
- A first version of WASA is taking shape, and will be publically deployed in the fall of 2001 at a mathematics exhibition at Stockholm's Technical Museum.

Additional CVEL results

Additional results include the completion of a user study designed to identify and measure differences in exam performances of students using the 2Reel learning environment and students using traditional literature studies. The hypothesis was that students would perform equally well, and results supported this hypothesis. We interpret the lack of negative results for teaching in a VR environment as highly positive.

Three experimental lectures were held in the CyberMath environment during the spring. One involved a lecture in linear algebra; assessment is in progress. Another lecture used an augmented reality interface allowing the lecturer, in Stockholm, to interact with students at Gjövik College in Norway, via avatars and via voice- and visual communication. Gjövik has expressed an interest in using this teaching methodology in their future curriculum. Finally, a museum style walk-through lecture was given to the CID advisory board, presenting the generalized cylinder exhibition hall in Cybermath. The presentation was held in the VR cube at KTH, which was connected to VR cubes in Göteborg and in London. To our knowledge, this is the first time three VR cubes have been connected for a presentation such as this. It was fascinating to observe how the necessary forms of interaction between the different avatars developed spontaneously to solve the presentational problems that occurred.

Results and experiences from CVEL experiments, 2Reel, and the CyberMath system have been disseminated at six national and international conferences during 2001. Additional conferences and seminars are planned for the fall.

In short, the CVEL experiments are on-track, on-time, and have even surpassed initial expectations and goals.

principle investigator	Yngve Sundblad, Royal Institute of Technology Stefan Seipel, Uppsala University
collaborative partners	Datadoktorn/Center of User Oriented IT Design LingoNet Stanford University Uppsala University Royal Institute of Technology

ISP-VL - Interactive Simulation of Patients - a Virtual Learning Space Project Report for the third project half-year (2001-01-01 – 2001-06-30)

Project aims and methods

This project aims to build a virtual learning-space for learning and training co-operative problem solving within the area of medicine. The project works to build a national as well as an international experimental environment and assessment tool, based on student activating learning methodology. The project uses the clinical learning situations of health care professionals as a model to explore the possibilities of virtual meeting spaces and of dealing with real time simulated patients. The basic pedagogical idea is to put the student "in charge" of defining and finding adequate knowledge with the help of advanced tools.
Furthermore, patient simulations are intended to get students emotionally involved, since an emotionally based learning has a high degree of retention.
The assessment process is ongoing and focuses on learning outcomes such as understanding of clinical problems and problem-solving, cross-cultural collaborative learning environments, educational procedures and routes in clinical problem-solving, impact on students' self confidence in clinical problem-solving and their emotional involvement, teacher co-operation in the advancement of simulation tools and different pedagogical methods and cost-effectiveness. In addition, the technical base of the system is monitored and evaluated.

Results

1. The prototype patient Brit has been translated and tested. The "standard patient case" (Britt Larsson), which was fully translated into US English during the last project period, has been used as a base for developing the first ISP-VL specific case, Elisabeth. See further details below.

2. A new Swedish patient case for use in ISP-VL project has been constructed. The ISP-VL specific Swedish patient case, Elisabeth, was completed during the first months of the current project period. Two different Elisabeth cases (HIV/PCP and Endocarditis) were fully developed. These cases were based on collaboration between faculty persons at Karolinska Institutet, Uppsala University and Stanford School of Medicine, with the physician Anders Thalme from KI taking the lead. These two cases were written in English, but a Swedish version is nearly finished. Important medical and educational contributions in developing this patient case was also given by the Stanford faculty members Julie Parsonnet and Lisa Gerwin.

3. A special Stanford patient for use in ISP-VL has been constructed. A Stanford patient case for use in ISP-VL has been under construction, and the manuscript developed by the Stanford specialists in infectious diseases served as a base when the Tom case was filmed in Sweden early this year, using a professional US actor. The first cases of the six planned will be ready for use during the coming project period.
4. Testing was conducted live during the European Union meeting at Älvsjö. The global collaboration technique and two of the Elisabeth cases were tested during the European Union top summit meeting at Älvsjö, Sweden.

The live demo was conducted by four students using top-of-the-line videoconferencing techniques from Ericsson. The event was inaugurated by the Swedish Minister of Trade and Commerce, Leif Pagrotsky, and served the project both as a "rehearsal" for the planned global sessions and as effective PR for ISP-VL.

5. Pilot courses have been given. The first ISP-VL courses were performed during April and May 2001. Two different set-ups were used:

1. A 3-day global course with students from KI, Uppsala and Stanford
2. Local distributed courses at Stanford and KI.

The global course was performed as a simultaneous course with students at all three universities connected though a video conferencing unit (Polycom) enabling all students to talk to and see each other at the same time as the simulated patient cases was run. All three student groups could interact with the system and even though there were faculty available at all three sites, the students were the active group. Even though the global course was mainly for fine-tuning the global collaboration set-up and testing the Elisabeth cases, all students were very positive to global collaboration in general and especially for working with ISP-VL as a tool for case based learning, in spite of minor glitches.
The two different local distributed courses were used both for further testing of the Elisabeth cases, and as a set-up for testing the implementation of learning tools as ISP-VL into different curricula. These pilot courses were one-day events.

6.A dedicated workshop for the two WGLN projects ISP-VL and PharmaPac was held in June. Project team members from Stanford, Uppsala, and KI participated. During this workshop, both project specific details for the ISP-VL projects were discussed as well as possible co-operation and information dissemination between the two projects. More than 30 persons participated in a very successful three-day workshop.

In short, the Interactive Simulation of Patients project is on schedule, and there are no constraints to project development. Co-operation and communicative aspects of running the project have functioned very well. The details of the pilot course, for example, were worked out in cooperation with teachers and course directors at KI, Uppsala and at Stanford School of Medicine. The assessment framework has been discussed and designed in close contact with the KI LearningLab Assessment team as well as with Stanford School of Medicine evaluation experts. Other SweLL and SLL Assessment team members have also been briefed about the assessment issues of the project.

There has been a frequent exchange between the staff at KI and at Stanford. This has mostly been done via e-mail, and file-transfers, but there have also been a number of videoconferences during the period. When the dedicated videoconference tool Polycom was installed at KI and Stanford, the video conferencing was greatly enhanced. Visits to and from Stanford of key staff have contributed greatly to the successful spring. Detailed plans, including those for course implementation and additional patient cases, for coming project periods have already been developed.
Further information related to the project http://isp.his.ki.se/

principal investigators	Rolf Bergin, Karolinska Institutet Uno Fors, Karolinska Institutet
collaborative partners	Stanford University Medical School Stanford University Media and Medical Information Technology Uppsala Learning Lab Karolinska Institutet Learning Lab

PharmaPaC - Pharmacological Patient Cases - a web based seminar course (previously called "Pharmacology and clinical pharmacology-Janus learning site")

Project aims and methods

To strengthen and simplify the process of learning about pharmacological and clinical principles by illustrating such principles in drug-related patient cases developed for the web. These cases are presented using web-based interactive techniques as an integrated part of group-based teaching.

The patient cases should help the student argue about best choices for drug therapy and drug treatment schedules. The cases should also enhance student learning of the principles of individualised dosage and provide training in critical methods of evaluating results from clinical trials.

Results

1. A multimedia system of websites (www.pharmapac.org) for patient cases was designed, implemented, and used as part of the two-week transatlantic course in clinical pharmacology described below. The website is a prototype but it contains several parts: one for answering the pharmacological patient cases; one for chat activities between students; one for summarizing answers from all students and a critical part for teacher-controlled construction of multimedia patient cases. The LITU team in Umeå had the technical responsibility for system design and programming.
2. A two-week course using the PharmaPaC website was carried out with 6 students from Karolinska Institutet and 6 students from Stanford University's School of Medicine. The Swedish students spent the initial week at Stanford School of Medicine together with the Stanford students. The students solved the patient cases. An equally important dimension of the course involved seminars for joint discussions of the solutions. A detailed assessment of the reactions to the course, to the concept, and to the specific cases were carried out. The students were interviewed individually before and after the course, using a structured, oral interview technique. For each case the student had to fill in a questionnaire about the value of the case and about technical issues.
3. The team from KI, LITU and SU met with the ISP-VL group (simulated patient project) in June of this year to summarize development work, to share experiences gained from the course and to present the preliminary results of the course assessment. It was clear that the students were very positive to the concept of using multimedia patient cases integrated into seminars for learning pharmacological and clinical pharmacological principles. Plans for continued work this year and preliminary plans for 2002 and onwards were discussed. The development group has agreed on a publication plan.
4. Presentations of both development work and the course have been in internal and external publications from SU and KI but also in national Swedish publications:

1. Pharmapac (Pharmacological Patient Cases) an interactive course in clinical pharmacology using web technology. Abstract. 5th Congress of the European Association for Clinical Pharmacology & Therapeutics, Odense, Denmark, September 12-15 2001

2. Clinical pharmacology for medical students. 3 Jahreskongress fur Klini sche Pharmakologie 2001, 15-17 November 2001 in Koln

5. There are already plans to use the Pharmapac concept of patient cases in several undergraduate medical courses at Stanford School of Medicine. At KI we plan to present the concept this coming autumn. The Faculty of Medicine at Umeå University has shown interest in studying the project concept.
6. The co-operation between the School of Medicine at Stanford, the technical team at LITU at Umeå University, and the team at Karolinska Institutet has been excellent. The teams in Sweden have collaborated closely in technical development. The design of the patient cases, however, is time-consuming. On the Swedish side, too many physicians and teachers have been involved. The final phase of design ran more smoothly.
8. A total of 25 persons, excluding the 12 students involved in the course, have been involved in the Pharmapac project so far. The time schedule has been followed strictly. Working relations appear to have been excellent. All persons involved have been trained in multidisciplinary teamwork. A prerequisite has been a number of trips and meetings. A critical part in the successful project development has been good, close co-operation between the overall project co-ordinator in Sweden and the American project manager.

In sum, the Pharmapac project has met and even exceeded expectations in several ways. Results including the preliminary pilot results of the evaluation have already been presented and discussed at a joint meeting attended by partners at Stanford and LITU at Umeå. This meeting was also attended by representatives from SweLL, WGLN, and teachers at the Medical Faculties at Uppsala and Umeå Universities. Detailed plans for follow-up and continuation extending beyond the 2000-01 project period have been developed, though financing issues have not been resolved.

principal investigator	Lars L Gustafsson, Karolinska Institutet
collaborative partners	School of Medicine at Stanford University Janus Telepharmacology Umeå University, (LITU) Stanford University Media and Medical Information Technologies Karolinska Institutet Learning Lab Karolinska Institutet

Evaluation team report

July-December 2000

Swedish Learning Lab promotes a culture of project evaluation, documentation and dissemination in the WGLN. Outlines a plan to create a practice and support tool for faculty to facilitate project development, evaluation and knowledge transfer.

August-September, 2000

WGLN practical guidelines are proposed for the Learning Labs' projects.
The guidelines have a three-fold framework. The first presents the theory-anchored evaluation in the WGLN. The second presents the evaluation support application (which is under development 2001). The third is a guidelines paper.

December, 2000

The WGLN evaluation framework was presented at a SweLL meeting at KTH.
The evaluation teams from SLL, SweLL and L3S all participate in an evaluation workshop at the Uppsala Learning Lab.

March, 2001

A database is specified to assist teams in defining and tracking WGLN projects. The database will make reporting easier and improve the insight on lab and network impacts. The evaluation groups leaders of all learning labs assumed responsibility for the fidelity of the database functionality to the theory anchored evaluation model. A full version of the database system will be tested in November 2001.

March, 2001

Research papers were published in the proceedings of the European Computer Support for Collaborative Learning conference in Maastrichth, Netherlands.

June, 2001

WGLN releases a first version of the Evaluation Support Application.

collaborative partners | WGLN Evaluation Team

Application development

Project aims and goals

To create a support tool to carry through the practises called "Theory Anchored Evaluation Approach" and also to stimulate creativity and interaction within the network.

Results

Implementation results: Implementation will take place during fall of 2001, positive feedback from evaluators on functionality and design.

Current state of the project

An alpha version has been developed, supporting the core mechanism of the theories. Interviews have been made and a proposal is being written at the moment to get the project money needed to develop the first version which will be launched in February.

Website: http://eval.wgln.org

project coordinator	Tomas Erlandsson, WGLN
collaborative partners	Swedish Learning Lab Learning Lab Lower Saxony Stanford Learning Lab

Network development

Stanford Learning Lab

Organizational changes at Stanford learning lab.

Learning Lab Lower Saxony

An additional grant from the German Ministry of Research (BMBF) for the L3S has been approved, based on an L3S proposal made in coordination with the Lower Saxony Ministry of Research (MWK). The grant both substitutes part of the MWK financing for L3S with BMBF funding and extends funding for the first three years, adding three new members to L3S (Prof. Floto / TU Braunschweig and IWF Göttingen, Prof. Studer / University of Karlsruhe, Prof. Effelsberg / University of Mannheim).

Swedish Learning Lab

The learning labs at the Swedish Learning Lab universities have consolidated their roles over the past year and have gradually become both more integrated and more visible in their local organizations. The KTH-LL is now a Center at KTH and a part of the new KTH Main Library Department. The KI-LL has been incorporated into the Department of Learning and ICT for alignment of resources. ULL has reorganized to better meet Uppsala University's needs and to create more momentum.

Faculty interaction

The academic content in the network has been developed by faculty from the WGLN partner universities in a series of workshops.

Workshop I: Interactive Spaces, Stanford University.
There were 42 participants in the first faculty workshop of the WGLN.

The goal of the workshop was to define areas of co-operation for faculty from the learning labs in order to design a collective research agenda. Specifically, this workshop addressed issues related to Interactive Spaces, including space design, architecture, technology and functionality in high performance environments. Planning for the use of classroom space in specific sites was discussed, including Wallenberg Hall at Stanford.

Research issues discussed included the organization and control of dynamic and flexible technical and spatial environments, real time distributed mentoring, technologies for bridging the physical space with mobile and virtual users, shared presence, and pedagogical aspects of interactive spaces. The workshop also gave faculty an opportunity to meet one another and share interests in one to one discussions. Faculty then co-developed the following project proposals based on the workshop discussions:

- Interactive Spaces (iSpaces), ver. 1
- Collaborative Virtual Reality Environment for Knowledge Mediation

Workshop II: Innovative Curriculum/Curriculum Design and Personal & Collaborative Learning Tools. Stanford University

There were 65 participants in the second faculty workshop of the WGLN.

Specifically, this workshop addressed cross-disciplinary, distributed or problem-based learning activities, tools for team- & trust-building, and knowledge management and e-folios. Working groups included those discussing: courselets/distributed learning, courselets/distributed content, collaborative teams, multidisciplinary/ communication, multidisciplinary/learning, and Portfolios/personal learning.

Participants reported the greatest benefits from face to face meetings due to an ability to brainstorm, become familiar with and discuss others' ideas, share or contrast opinions, get different perspectives, and work in small groups. Several reported benefiting from a structured agenda that moved toward development of a project and proposal. Faculty formulated the following pre-proposals, or Letters of Intent:

- Personalized Access to Distributed Learning Repositories (PADLR)
- Global Learning Teams
- Interactive Laboratories (iLabs)
- Visualization and Simulation Environments to Solve Difficult Learning Situations (VASE)
- Training in Labor
- Distributed Critique
- iRite
- Learning at the Edge
- Mobile Learners
- Interactive Simulated Patients-Virtual Laboratory (ISP-VL)
- Pharmaceutical Patient Cases (PharmaPac)
- T-Competency
- L3SCPD
- Personal Learning Portfolios: Folio Thinking
- Interactive Spaces (iSpaces), ver 2.

Workshop III: Performance Spaces and Events. Royal Institute of Technology.

Ten Participants from Stanford, L3S and Sweden. The focus was the design, technical infrastructure, and uses of large meeting spaces. This research has two parts:

1. How can a large group participate actively in a discussion, collaborate with each other and with distributed partners and engage in artistic or performance based events? The questions include architecture and furnishings, technical issues of large-scale visualization and representation, information flow and control, sharing and capturing, enhancing distant presence etc.
2. What kinds of events would best exploit a performance space, and how can we manage and produce such events? Issues of distributed artistic collaboration come to the fore. How can sophisticated complex events be coordinated, planned and performed between large distributed groups? Are there certain kinds of formats or art forms more suited to such a process?

Results

- Proposal outline on use of performance spaces
    - Furnishing and equipment
    - Multiple use
    - Simultaneous and distributed use
    - How to create a sense of distributed presence etc

- Definitions of terms and concepts; performer, performance space, linked spaces, roles.
- Creation of a community with a common frame of reference, platform for continued collaborative exploration
- A community which will continue to produce inspirational material for the WGLN community on the performance theme; What framework for art experiences? How can we transport experiences, emotions, moods and atmospheres which people experience at the theater to the learning environment and the learning space to create a new kind of learning experience?
- Student exchanges

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Glossary of acronyms and abbreviations

APE	Content Archives, Student Portfolios and 3D Environments
ART	Applied Research Team/ Assessment and Evaluation Team
CCM	Content and Context of Mathematics in Engineering Education
CID	Center for User Oriented IT Design
CREATE	Creating Research Examples Across the Teaching Enterprise
CVEL	Communication and visualization Environments for Learning
DDG	Directors Development Group
DILS	Distributed Interactive Learning Spaces
DRH	Digital Resources n the Humanities
DSV	Department of Computer and System Sciences
GCE	Global Collaboration Exercise
HIS	Humanities, Informatics and the Social Sciences
ICT	Information and Communication Technology
ISP-VL	Interactive Simulation of Patients: Virtual Learning Space
KAW	Knut and Alice Wallenberg Foundation
KI	Karolinska Institutet
KILL	Karolinska Institutet Learning Lab
KTH	Royal Institute of Technology
KTHLL	Royal Institute Learning Lab
L3S	Learning Lab Lower Saxony
PharmaPaC	Pharmacological Patient Cases
PI	Principle Investigator
SICS	Swedish Institute of Computer Science
SLL	Stanford Learning Lab
SUMMIT	Stanford University Medical Media and Information Technologies
SweLL	Swedish Learning Lab
UAS	Uppsala University Hospital
UML	Unified Modeling Language
ULL	Uppsala Learning Lab
UU	Uppsala University
VR	Virtual Reality
WGLN	Wallenberg Global Learning Network

www.wgln.org