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ABSTRACT

In 1996, the Virtual University (VU) started as an online learning project at the University of Hagen (Germany) with a few courses and a small number of users. Today the VU has grown into a large learning platform with a student community of more than 10,000 and more than 200 learning events online. This paper describes some of the experiences related to the development and use of the VU and outlines the effects on all areas of the university. Not only has the learning environment and process of students changed dramatically, but faculty, administrative staff, and technical support personnel have experienced fundamental challenges and reorganization. The VU is leading toward a major quality improvement in open and distance education. The impacts of the VU are described in the following areas: (1) impact on learning, including communication and interaction, tutoring and student support, topicality, applicability, and innovation; (2) impact on teaching, including communication and interaction, tutoring and support, topicality, applicability, and innovation; and (3) impact on management, including the computer center, printing and shipping department, and study center. (Contains 23 references.) (MES)

Five Years Virtual University – Review and Preview

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Abstract: In 1996 the Virtual University (VU) started as an online learning project at the University of Hagen with a few courses and a small number of users. Today the Virtual University has grown into a large learning platform with a student community of more than 10,000 and more than 200 learning events online. This paper describes some of the experiences made with development and use of the Virtual University, and in particular outlines the variety of effects on all areas of the university. Not only has the learning environment and process of students changed dramatically, but faculty, administrative staff, and technical support personnel have experienced fundamental challenges and reorganizations.
The virtual university is leading towards a major quality improvement in open and distance education. Many papers describe technical, didactical or legal aspects: this one aims at giving an insight into the complex impact on the whole organization.

Paper Outline

This paper describes how a research initiative, the Virtual University project, grew into a project that changed the appearance and the processes of a whole large organization, the University of Hagen. The paper presents a short review of how the project developed, and then explains how the different user groups were affected by the new teaching and learning paradigm. Finally, some necessary further developments are outlined.

1. A brief review

As life-long learning is getting more and more essential in professional life, learning via Intranet and Internet is becoming more an more popular and successful and distance learning is getting more important. The University of Hagen has an experience and a tradition of distance education since more than 20 years. Therefore, it was a logical consequence to use the Internet for learning and teaching purposes. The benefits of distance education, time - and location independence and the advantages of the Internet (fast information, easy communication and co-operation possibilities) were combined in the project Virtual University, Germany's first university to offer all its services in the internet. The Virtual University (VU) is a model for a modern education system.

The project is experimenting with and evaluating different forms of teaching and learning in the Internet. When the project started a suitable software platform was not available for our purposes, so a platform was built based on Internet technologies and a commercial database system. It is a virtual university system that integrates all functions of a university into a complete, homogeneous, extensible system with an easy to use and intuitive student-centered user-interface. The project started with only a few courses of electrical engineering and computer science, however, courses and events from all department were moved to the system over time. For instance, after the first year more than half of the courses came from humanities. This clearly contradicts the original assumption that web-based learning would be accepted easily by the technical departments and their students, but would be accepted very slowly in non-technical departments. Currently, more than 10.000 students are using the Virtual University of Hagen. Since the beginning of the Virtual University more than 200 virtual learning events took place. The

experiences are positive throughout.

The functional structure of the Virtual University was surprisingly stable over the last five years. Even though the graphical appearance was reworked completely, the organization of the information space did not change at all. Of course, the technical infrastructure has been continuously improved. The most important and critical extensions of the systems over time were tools for the staff and for administrators. This is an ongoing effort to improve efficiency and usability, especially for non-technical personnel.

The home page of the Virtual University offers the following functions:
education - for participation in courses, seminars, practical training and exercises; *news* - a campus wide blackboard containing all sorts of up-to-date information relevant to the users of the Virtual University; *office* - the component including administrative functions; *research* - offers access to all research-related activities in the university; *cafeteria* - a forum for social contacts between students; *library* - offers access to both traditional and digital libraries , *information* - provides general information about the university; *shop* - offers all material that can be purchased from the university

2. Impacts on Learning, Teaching and Management

2.1 Impacts on Learning

The experiences made with all types of teaching events (courses, seminars, exercises, practical training, etc.) were absolutely positive. For instance, a user survey in 1999 showed, that the intensity of the contacts in virtual seminars is substantially higher than in conventional seminars, also the readiness to form working and learning groups. Most students expressed the opinion that the discussion quality is higher than in conventional seminars. The majority of the students scored the offer of online-seminars with "very useful" (Mittrach 1999).

Another aspect is the dropout rate, always a problem in open and distance teaching. The drop out rate in the virtual seminars was significantly less than in conventional seminars.
What are the reasons for such improvements?

2.1.1 Communication and interaction

The students in a distance teaching environment essentially work by themselves, except for the very rare events where group work on the campus is required. This easily leads to a feeling of isolation, emotional distance and helplessness. Hence, it does not come as a surprise that the major impact of the Virtual University derives from the communication and cooperation features it includes and stresses. Where the students feel connected, they have a much lower tendency of just giving up and leaving, which, in other words, explains the better success rate in the Virtual University.

In the Virtual University communication and interaction possibilities are connected with teaching and information material everywhere. At any point inside the learning material students are able to enter a discussion group, to write an email, check the newsgroup, even to start a video conference (if available, but most students prefer text-based communication). Technical possibilities are interlinked and presented in a user-friendly way. Students are now able to search in the library, to do online exercises (e.g. compiling programs, fill-in text, simulate processes, etc.), to track the status of their corrected tasks (sent in, in progress, corrected, and finally the results), to archive their results and, very important, to communicate with each other and with the teacher.

Our experiences show that the majority of the students prefer asynchronous communication media like email and news, because of their time and place independence. The favored synchronous communication tools are text-based tools like chat. Videoconferences are mainly used for consultation-hours and oral examinations.

2.1.2 Tutoring and Student Support

Nobody should be left alone with a problem in the VU. Suitable communication partners can be found in the information area (common information), in the teaching materials or in the newsgroups. It is essential to support all kind of contacts: between students, between students and their teachers, and between students and organizational staff.

Newsgroups and email were not a novelty at the University of Hagen. These tools have been used some time before the VU. However, a new quality was reached through the Virtual University by the fact that communication became *context-oriented*, available in all situations and at all times. Students do not need to change between different tools, websites, etc.: all functions required are presented in a context-oriented way in one learning environment. Moreover, various mixtures of digital communication became a central medium for certain teaching events like seminars.

2.1.3 Topicality

It turns out that the Virtual University contributes to more up-to-date and consistent information and documents for students. Prior to the VU a lot of redundant and sometimes even contradictory information was available, course material contained errors and was not always up to date. Now information could be delivered just in time, mistakes can be corrected instantaneously, and difficult issues can be explained with additional information given in an ad-hoc way.

Students reacted soon to these dynamic possibilities of the VU: they show up, if mistakes are found and issues are explained poorly.

2.1.4 Applicability

Students have now the ability to learn directly on-the-job, to take part in cooperative processes, to initiate and to work in virtual teams. They learn to organize themselves and to produce high quality solutions within a group. The direct access to different information resources is a great support for our students and prepares them for typical work-environments in industry. Especially our working students (80% of all students) have a direct advantage of these experiences.

2.1.5 Innovation

The communication and interaction possibilities and the integrated technical features create new forms of teaching methods. Not only practical training, but also online exercises, virtual laboratories, interactive training (fig. 1) and virtual seminars now are common in the VU. Students evaluate the interactive elements as a great support for understanding complex topics. Among these interactive elements are virtual laboratories, simulations, style checking and compiling programs in exercise environments, graphical exercises etc. The following two examples illustrate some of the new learning methods which are typical for the VU.

2.1.5.1 Example 1: *Real systems in the virtual laboratory*

In this new environment we can run practical training from the distance even for systems only available at central locations. An example is a robotics practical training: the user writes the control software for the robot, then transmits it to the robot in the central lab, where the robot executes the commands it receives. The user can closely watch the robot's behavior via video, and can thus see and hear what happens, instead of just getting feedback data from a simulation system.

This kind of learning and experimenting from the distance also is of special interest for continuing education, technology transfer and industry cooperation.

2.1.5.2 Example 2: *Virtual seminars*

The virtual seminar has already been mentioned several times in this paper. It is one of the didactically challenging teaching events at the Virtual University, as seminars have traditionally been defined as teaching events with teacher and learners present in one location, and nobody ever tried to do seminars at a distance. Virtual seminars are very popular among students.

The Internet services used for such a seminar are email, ftp, news, chat, audio- and video conferencing. Services are specifically combined for different seminar phases. There are also mixed forms between virtual and conventional seminars, e. g. only certain seminar phases are assisted by Internet-based tools

The virtual seminar allows a well-structured teaching process using online as well as off-line communication tools which support the student's learning success. Seminars get a new quality: In contrast to conventional seminars a continuing learning process is triggered, and the discussions taking place in the Internet are much more structured and disciplined than in conventional seminars (Feldmann 1999).

Internet based communication tools enable and motivate very active communication, co-operation and discussion processes. People really interact as opposed to the typical traditional "listen and then (maybe) ask a question" behavior. The forming of groups and learning together in the net are new and highly valuable experiences for the students.

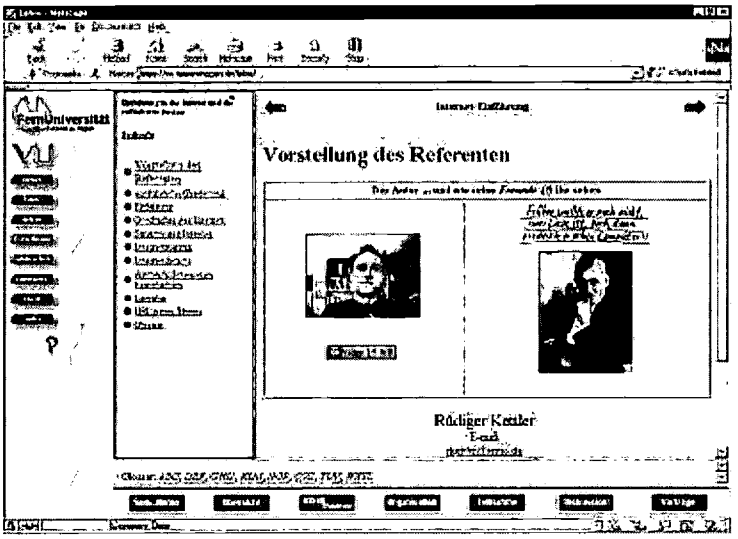

Fig. 1: A student's contribution

2.2 Impacts on Teaching

Most papers on virtual universities focus exclusively on the students. Let's have a look at the teachers. If done wisely, teachers benefit from a VU approach; if done naively, teachers may easily get drowned in communication, email, etc. At the University of Hagen teachers are professors, research assistants, mentors in the study centers and tutors (whose task is to correct student exercises).

No need to say that the success of a VU approach completely depends on the positive attitude and active participation of the teaching staff – but important to note, that this is the major hurdle in real-life when it comes to implement a VU! It is easy to get enthusiastic students, but a completely different job to motivate the staff.

For the teachers everyday life changes in the VU. More and more, the teacher gets to support the student's learning process, to organize learning, to act as a guide, instead of delivering information.

Not too many of our teachers liked the idea of changing their everyday life, but experience showed that their prejudices (e.g. to get too many emails or to have problems with the technology) were not confirmed once they kept to certain rules. This, however, required some creativity and much patience on the part of the VU developers.

Let us highlight some of the major changes experienced by the staff:

2.2.1 Communication and Interaction

The easy availability of Internet-based communication media made people assume, that students will use these tools in such a frequency and in such numbers that teachers would be overloaded with masses of questions, requests and comments. If not done properly, this of course may be the case, but if the philosophy is to imitate the students' behavior on the campus, then something different will happen: students start to organize themselves in the newsgroups instead of going for the teacher all the time. The reason is that the teacher is not always available, will take some time for a reaction, but other students are always out there and somebody is always ready to jump in. Thus, the teacher can concentrate on the issues that produce serious problems for students, and can sometimes lead

the discussion where necessary. It is essential for the teachers to organize and if necessary to delegate communication processes (e.g. generating FAQ, editing drafts for common questions, organize cooperative work).

2.2.2 Tutoring and support

As mentioned before, teachers worry about the changes in their daily work. To support our teaching staff, we implemented (and are still implementing) a variety of different tools, such as emailing to different user groups, a campus-wide easy to use blackboard, the automatic generation of newsgroups for new learning events, and so called "teaching assistants", software packages that help to set up, structure and run complete courses or seminars. Shortly the teachers learned about the major benefits in their daily work:

- students have rather good contact to tutors, they know their students much better than before
- continuous communication between the students and the teacher throughout the courses, so it is now possible to track the learning process and to intervene on time before a student drops out or fails an exam. Homework is much better than before, even better than homework typically is at a campus university.
- discussing questions and problems is time - and cost-effective
- building of learning and working groups is possible, students support each other instead of looking for help from the teacher
- it is possible to find overlaps in the student's topics and to provide hyperlinks to each other's contribution
- if classroom phases are integrated in a course, these can be used for discussions on a rather homogeneous starting basis. Furthermore, the time needed to get to know each other is shorter than in conventional courses

2.2.3 Topicality

The topicality of documents is one of the main advantages of web based teaching material. Instead of writing one document and then sending it to the students, there is now a continuos process of correcting, adding information, and updating information. Students now expect up-to-date material.

The fear teachers have is that it is too much work to update data in different systems and to archive different versions of one course (students must have the chance to be examined according the version of a course they were enrolled in, even if this version is an older one). However, with the appropriate data management system and integrated version management these processes can be supported in a very user-friendly way.

Another important support feature is to install easy to use upload possibilities and a clear navigation structure for the existing material (authors and teachers are not always the same persons).

2.2.4 Applicability

Applicable contents are a quality requirement for a university with more than 80% working students. The Internet is a highly usable instrument to collect and present applicable contents. Searching, retrieval and publishing is a lot of easier for the teachers using modern technology. Most of our teachers using the VU were inspired by the new publishing possibilities, even though they had to spend some hours in creating web content. To support the teachers, the VU developer group provided their experience through hotlines, tutorials, etc. This support was essential for a positive motivation of the teachers.

2.2.5 A Word about Innovation

Innovation is a coin with two sides. On the one side there is the potential to simplify daily work by the use of innovative technology, on the other side are the people - responsible for the use of innovative tools but feeling uncertain in this new world - and thus tend to keep to traditional patterns.

Our teacher interface, personal assistance and the demands of our students helped them to see the benefits, to improve the daily work and - as a result - to convince colleagues to participate in the VU.

2.3 Impact on Management

The third group concerned of the VU is the university management. The management's responsibility is usually the enrolment process, administration of students data, student information, billing, etc. – shortly all organizational tasks around the study. In the beginning of the project nobody inside the management realized the Virtual University platform with it's few users and they even don't want to recognize it. Now, five years later, a lot has changed for managers and their staff.

To deny an increasing number of students and their demands was not possible. More and more students started to study virtually, and surprisingly more and more tutors and teachers used the system to support their work, and even the management staff utilized the system to search for information, to get an overview about the latest news, to announce new information for the students, etc. In the second year, the VU caused several problems: More and more students wanted to download their courses directly through the web, with the consequence to find new billing processes for them. They demanded electronic enrolment and more electronic course material.

Furthermore the stock increased, thus data transfer had to be automated. Teacher and tutors refused to feed in their data in different systems, so a synchronization of VU and organizational systems became necessary.

The general management of the university realized the potential of virtual teaching. In 1997 they started to promote the system in the different organizational areas. By the help of additional money for extensions of the VU, for electronic study material and other improvements around the virtual teaching and learning area the ground for further developments was ready.

2.3.1 Computer Center

The largest visible impact is the delivery of the whole system to the university's computer center, because it is not possible to run a system with more than 10000 users as a research prototype with only a few persons. To become the delivery successful many changes and improvements had to be implemented. E.g. the database (Sybase) had to be changed to the official university's database, an Oracle database. Passwords and the whole VU stock has been transferred to the computer center's database.

2.3.2 Printing and Shipping Department

The delivery of the study material will change in the future, more and more students download their material, the shipping of documents will decrease in the long last. Therefore the tasks of the shipping department are changing, not all people are liking such developments. Instead of producing paper material the shipping of CDs with large data, videos and audio data will increase. The production process of paper teaching material had to be synchronized with the electronic material, to avoid irregular contents. A professional content management system could be a possible solution for this problem.

2.3.3 Study center

The study centers modify from an university bureau with several administration and support facilities towards modern communication and support centers, serving the students the necessary technical equipment and support in using the VU. The external tutors in the study center itself use the VU as a tool to administrate their own teaching events (e.g. exercises) and to inform about the current courses and about the students enrolled in this courses.

3. Preview

The transfer of the software platform to the university computer center could not be the last thing to be done. The increasing number of users and new technological developments require new and better tools for the VU. The most important running improvements are the following:

- **Tutor support tools:**
  The existing tools should be extended with better possibilities to manage News, Emails, cooperative workspaces. New workflow components could ease the daily work of the teachers.

- **Communication and interaction:**
  Integrated instant messaging and a pool of available communication profiles should support the important communication and interaction processes.
- **Data management:**
  This component is essential for a smooth and secure handling of the complex universities data stock.
  Furthermore a professional content management is necessary to optimize the process of editing and publishing learning materials in different systems.
  Another aspect is the congruent data management, which is currently in progress with a new developed core data base for all organizational data concerning the different courses.

4. Summary

The Virtual University project was a real success in the sense that it developed from a research initiative into a comprehensive change of the whole university.

Students, teachers, and administrative staff have contributed to this transformation. A major driving force, though, were the students: once the project was under way, the number of participating students increased fast, as did their requirements, so that the development could hardly be stopped or neglected.

The large number of participating students finally forced the university to accept the project developments as a general service and to move the infrastructure and the support services from the project into the university computing center. The consequences for the university organization were underestimated at first, but the problems were solved as more and more persons accepted the approach.

The overwhelming success of the project triggered the foundation of two start-ups which make the know-how of the Virtual University developers available to industry.

The students feel that the quality of their studies has substantially increased, the teaching staff is finally getting used to the new form of teaching, computing center and study centers are catching up with their new role and change of daily work.

The main lesson we learnt is that, in order to get this kind of project accepted, all user groups must be involved at the earliest possible time. This includes administration, which is often overlooked, as many processes and tasks change in a fundamental way on the road to a virtual university.

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