The Digital University (DU) is a consortium of ten universities in the Netherlands. It was founded to focus on the development and application of digital products, both software and content, and knowledge for Dutch higher education. Together, the affiliated institutions represent over 35 percent of the students enrolled in the Dutch higher educational system.

samenwerken aan vernieuwing van het Hoger Onderwijs

DU Digitale Universiteit

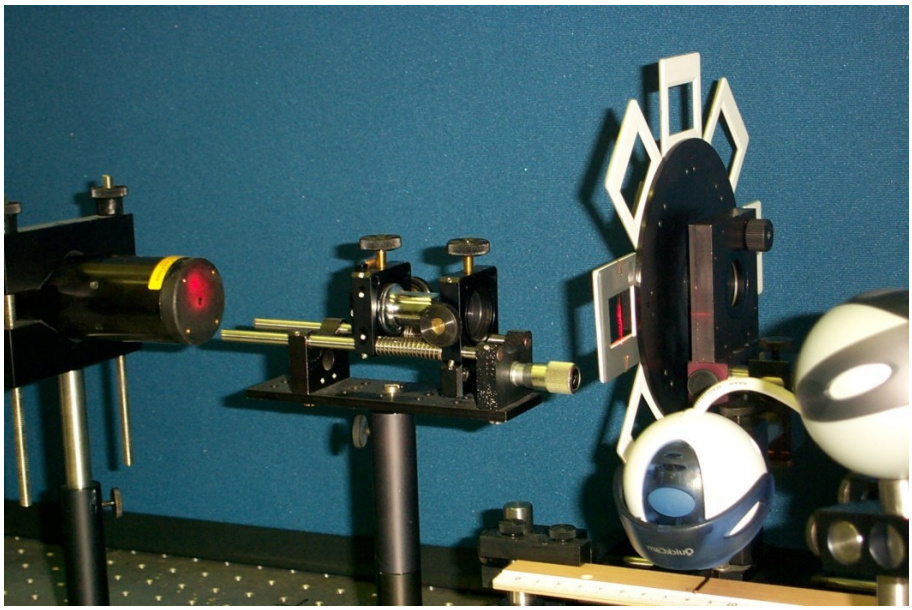
e-Xperimenteren+

Remote physics labs

Pool of experiments and software environment

Website: http://www.du.nl/remotelabs/

The *e-Xperimenteren+* project is an innovative project in the field of remote experimenting for educational purposes for Dutch universities. The project was started after a successful pilot project that resulted in several remote experiments.



Detail of the setup of one of the remote experiments. Visible are a laser, a movable carrousel with objects and a webcam.

Products

The main products of *e-Xperimenteren+* are:

- A pool of remote physics experiments that can be used in higher education
- A software environment to manage reservations and experiment results
- Tools and manuals to easily add new experiments to the pool

Apart from these main products there are documents about good practices of using the experiments in educational settings and using electronic journaling.

e-Xperimenteren+

Motivation

Remote experimentation is a trend that has become visible during the last years, both in scientific research and in commercial organizations. In education it can therefore be useful for students to become familiar with this new method of experimenting.
But there are other reasons why online experiments can be a valuable addition to current educational programs. One can e.g. think of an increase in the availability of experiments. Examples are the possibility to perform an experiment remotely in a lecture room (where normally no laboratory equipment is present), from home, and outside the normal opening hours of the lab. Other examples are the possibility to offer access to experiments that are normally too dangerous for bachelor students (e.g. experiments with ionizing radiation) or experiments that are too vulnerable.
Finally, remote experimenting can lead to financial benefits, by sharing expensive equipment between institutions.

Pool of remote experiments

Initially, about twelve experiments are set up in the pool, including three weather stations. Some of the titles are: *X-ray Fluorescence*, *Laser Doppler Anemometry* , *Michelson Interferometer*, *Level Control* and *Speed of Light and the Doppler Effect*. A complete list of the experiments with short descriptions and manuals can be found at the website of *e-Xperimenteren+*.

Software environment

The experiments are embedded in a software environment that features amongst others:

- *Reservation and access:* A flexible system for reservations and access rights is used. *Experiment bundles* determine who can make a reservation for a certain experiment and contain also properties like the maximum reservation time and validity period.
- *Storage of measured data:* Data that was measured during an experiment is transferred to a central server were it can be accessed by the student after the experiment is finished.
- *Automatic experiment log:* Important user actions are saved automatically to a log during the experiment. The student is able to add additional remarks to the log and can access the log also after the experiment is finished.
- *Experiment monitoring:* The status of all experiments is monitored continuously. In case a problem occurs with an experiment an email is sent to the maintainer of the experiment automatically, enabling the maintainer to solve the problem as fast as possible.

Community

An important goal of the project is the cooperation between different universities. We hope that not only the pool of experiments will expand in the future, but also the number of people and institutes involved.
For this reason a community is set up. Institutes that participate in the community are expected not only to use the remote experiments of others, but also to offer experiments of their own to the other users in the community. In this way we can keep the participation fee low. Another important task of the community is to collect, conserve and disseminate expertise.

Website

More information can be found on the website of *e-Xperimenteren+* at http://www.du.nl/remotelabs/.

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