

## **E-Learning – A new tool for the education of young scientists in the humane treatment of experimental animals: A contribution to the 3R**

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### **Abstract**

Life science disciplines may necessitate the use of animals in research and education. The most important requisite in animal experimentation is that scientists and their personnel are well trained, cautious and sensitive to the needs of the animals. Currently there are no obligatory training guidelines and available training differs greatly between institutions. The aim of this project is to develop an e-learning program which will be adaptable to different aspects and study focuses to assist in the progress of harmonising specialist education, currently with emphasis on German guidelines and regulations. A future perspective will be to assist in international harmonisation of the humane treatment of experimental animals. Content and complexity will be in accordance with the FELASA guidelines. Video and picture material will serve to communicate theoretical and practical considerations of experimental animal work and will help to sensitise young scientists for humane handling of animals in research. Thus computer assisted learning (CAL) will be a valuable tool to mediate knowledge through animation and simulation; and to open new ways of communicating important questions in laboratory animal sciences. The future focus of the e-learning program will be on the application of the 3Rs in experimental protocols.

**Keywords:** harmonising specialist education, experimental animals, 3Rs, computer assisted learning

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### **Introduction**

Computer and internet are now widely accepted tools in education and research. In the past two decades new teaching and learning strategies have been developed and implemented. Many institutions and organizations now include computer assisted learning (CAL) either office based (CD-ROM) or online tools in their teaching curriculum and as educational resources. Examples are the Virtual Physiology CD-ROM series (ISBN 0865777500, Thieme Medical Publishers) and online resources such as the AALAS Learning Library and the IACUC training homepage of the University of Arizona.

While these programs generally serve to introduce necessary theoretical background and skills most of them are restricted to institutional members and emphasize on only one laboratory animal species at a time or one aspect of experimental animal work. In addition, teaching alternatives in higher education mainly deal with comparative physiology and anatomy of vertebrates or are concerned with

alternatives in veterinary education. While there are many alternative teaching resources for e.g. pharmacology, dissections and physiology (Jukes, N. and Chiuia, M.; 2003), not many programs are available to educate students/staff in respect to integrating legislation, humane treatment and practical approaches to experimental animal use. Most teaching alternatives focus on general education in the life sciences and veterinary medicine but not on introducing and preparing students/people for working with animals in scientific experimentation. The German Animal Welfare Act demands specific training competency for persons engaged in the use of animals for scientific purposes (§9 TSchG, 2006) Currently however, there are no obligatory guidelines or specifications for the qualification and training of people who will be engaged in laboratory animal work. Thus, most curricula are based on departmental needs and will differ between institutions. A learning environment which will facilitate continuous learning and embed resources from different institutions and

backgrounds will help to meet educational needs in a variety of educational settings such as post secondary education, training of animal technicians and scientific personnel. Advancing the use of the internet as a teaching tool will serve to introduce a highly adaptable study environment. Students will be able to study when and where they choose and by having an online study program will be able to make further use of the internet by accessing additional online material, search tools and linked information.

In this context, "Experimental Animal Work online" will bring together legal aspects [at present with focus on German and European legislation] and practical considerations in husbandry and biology of common and exotic laboratory animal species, as well as genetically modified organisms (GMOs) and of farm animals used in research. Practical questions will include (but are not limited to) handling, sample collection, anaesthesia and analgesia as well as important surgical techniques, determining pain, distress and the necessity of humane endpoints and therefore appropriate euthanasia where applicable. These issues will be addressed by presenting video and picture material and by including short interactive sequences as well as online assessments of the study progress. Further we are aiming to implicate issues concerning the use of animals for research questions in basic research, biomedical applications and the industry. In this context the concept and application of the 3Rs and their realization will be discussed in a specialised chapter. Students will be introduced to additional online resources, such as the ALAAS, ECVAM, EURCA, FELASA and the GV-SOLAS web pages and the NORINA database.

In short, our web application will illustrate generally accepted guidelines and protocols in the design and practice of scientific methods of animal experimentation, as well as federal and European legislation. Against this background, we postulate that such a program can assist in integrating learning objectives and the implementation of animal protocols, proper scientific techniques and alternatives, not only in Germany but on an international basis as well. By this, we hope to reduce the number of animals for teaching purposes and further on in experimental protocols.

Aside of creating teaching material ourselves, we hope to involve instructors at other institutions to share and include their knowledge by releasing learning objects that were previously only available for use within specific institutional programs. As an example we will include some of the highly instructive picture and video material of the "Digires Picture and Video Collection" (P. Flecknell).

The integration of multimedia contents such as video and pictures, as well as audio comments and the design of self assessment tests within the program

can provide a complex learning aid that is highly adaptable to the requirements of practical course work at single institutions and for the individual student.

## Methods

"Experimental Animal Work online" will be based on the open source content management system (CMS) TYPO3 and will be available to institutions free of charge. Access to the platform will be restricted through a simple registration/login window. Teaching staff members of the individual institutions can easily administrate their own users or groups, include (scheduled) online tests and publish specific content and supplementary material within the page. This content can be limited to users at their home institution or can be made available to different or all user groups.

User administration and rights management, as well as workflow management will be in the so called 'backend' domain, while editors can work on content in the 'frontend' (directly on the webpage) through a simple login. *Editors can navigate through the site and make updates and additions and thus, no html or javascript knowledge will be necessary.* The backend of TYPO3 offers more advanced editing features and tools. Here, editors – depending on their assigned rights - can create and insert pages, add specialised content or translations, upload files, create and manage user groups etc. For this reason the CMS based webpage will be of interest to a variety of institutions and facilities. Foreign/ international legislation and scientific procedures can easily be added and made available to specific user groups while more specialized content can be excluded from the curriculum. Whether instructors will make use of adding content and administrating their own user groups will depend on the extent in which single institutions want to make use of the platform.

The advantages in using a CMS for e-learning purposes are:

- no special software requirement – editors can access and work from their office/ home computer online
- adaptability to different aspects and study focuses
- easy integration of computer files, image media, audio and video files, electronic documents and web content
- the implementation of learning assessments and online exams
- integration of specialised content for specific user groups and institutions
- user administration with precise rights management
- a simple User Interface – no html knowledge necessary

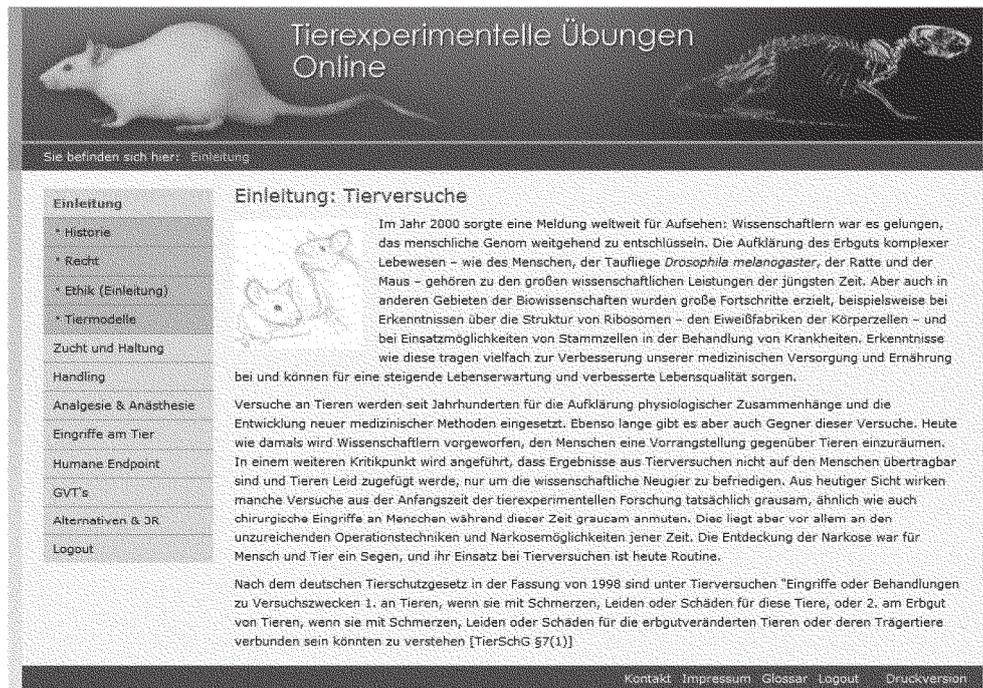


Fig. 1. Screenshot of the e-learning platform "Tierexperimentelle Übungen online" (Experimental Animal Work online). The left navigation links to the main chapter and subchapters. Content and pictures will be provided in the main page frame and additional links, specialised information and news can be displayed in a right page frame.

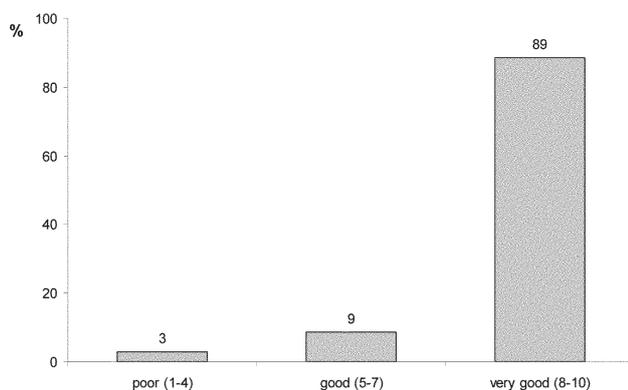


Fig. 2. The students were asked to evaluate whether they found the information, provided in the webpage, helpful for preparation of the practical session. Each student was subjected to a short oral examination before the start of the practical session. More than 90% (89% Very good, 9% good) rated the webpage as a valuable resource for information.

Sharing resources will support the process of good course design, teaching practise and harmonising education. Learning objects can be reused and existing freeware can be integrated into the program. Instructors therefore will avoid repeating design work already performed, and are free to focus on meeting broader teaching objectives then otherwise possible.

## Results

To assess the acceptance and performance of the platform as a tool to prepare for experimental animal procedures in a classroom environment, a

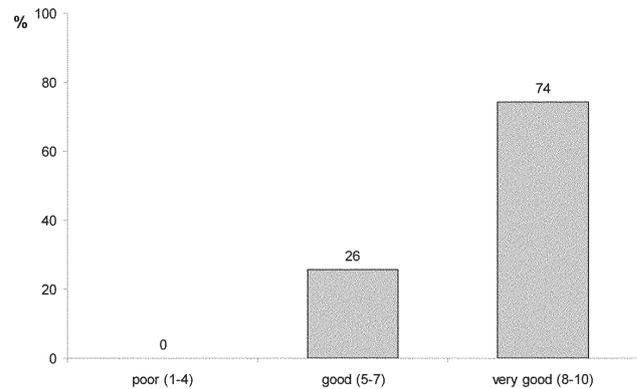


Fig. 3. Rating of the picture material in preparation for the practical course work. 74% of the students rated the material as very good and would have wished for even more pictures to demonstrate special procedures (oral communication).

beta version of "Experimental Animal Work online" was tested in an introductory course on experimental animal work. The Course participants (n=35) were asked to anonymously complete a questionnaire before and after the practical sessions (handling, minor procedures, surgery). General performance, usability, layout, and helpfulness of the video and picture material of the platform in preparation to the practical course work were evaluated. Appraisal criteria where ranged from 1 (poor) to 10 (very good).

Overall, the rating of the e-learning tool by the course participants was positive. The platform was generally accepted as a tool to get introduced to working with animals in an experimental

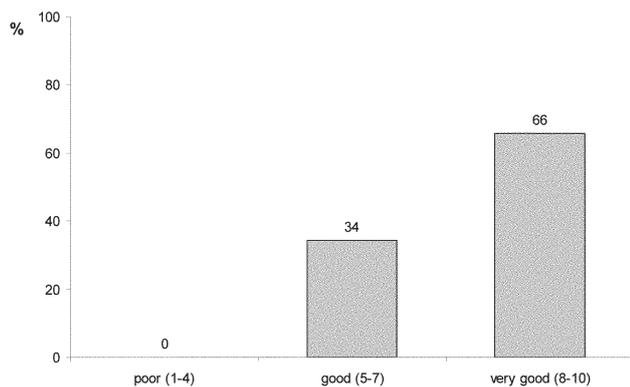


Fig. 4. Rating of the videos after practical part: The videos were considered useful to demonstrate scientific procedures in laboratory animal work and as a good representation of the practical course work by all students. A drawback was the exclusion of audio which was the reason why 34% of the students rated the video material as good.

setting. More than 90% considered the program valuable to prepare for practical animal work (fig. 2). In retrospect, this impression was even more strengthened. Students who had previously disregarded this medium reconsidered it as helpful after completion of the practical coursework (oral communication). The embedded picture and video material was rated as useful for preparation prior to having "first contact" with life laboratory rodents (figs.3 & 4). The main issue in respect to the overall acceptance of the videos (66% rated the videos as very good and 34% as good; fig.4) was the exclusion of audio in the beta version. Students communicated that they would have preferred audio explanations over written descriptions.

Although the e-learning module was universally accepted as a means to get introduced to practical aspects of the course work and as a source for additional information, about 70% of the students would not consider it as a substitute for ex-cathedra teaching (data not shown). Further, the majority of the students (97%) were of the opinion, that lecture and e-learning (including online demonstrations) could not supersede the practical part (fig 5).

## Conclusion

Since sole theoretical training cannot supersede practical aspects in the education of people in experimental animal work, working with animals is an integral part of many curricula in life science and research. In view of ethical considerations and the application of the 3Rs, practical training should be limited to people directly involved in working with laboratory animals. In our opinion a thorough understanding of the underlying techniques before practical course work or experimental procedures will help to sensitise and prepare students for laboratory animal work. To reduce the use of animals for certain teaching purposes, presentation of common

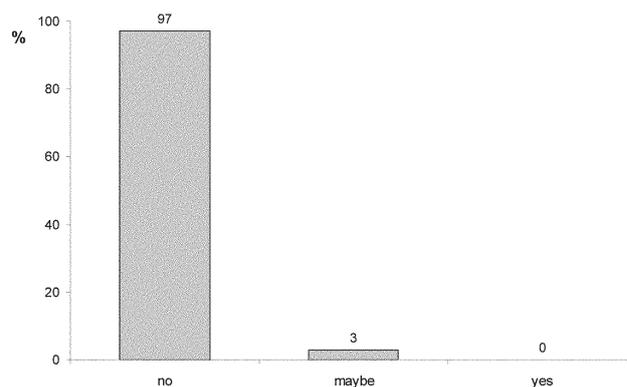


Fig. 5. When asked whether e-learning could replace animal labs in teaching handling and scientific techniques for working with laboratory animals, the majority of the students (97%) did not consider it as a substitute.

procedures by means of video demonstrations and portrayal of stress induced behavioural pathology of animals should be included in nowadays teaching. A commonly available web application that could be either used as stand alone course ware or in a blended learning environment will greatly contribute to achieving this goal. Web applications allow for a better accessibility of teaching material and a more flexible study environment. Even more, the use of animation, videos and pictures will give better comprehension of scientific study design, preparation of workspace and the importance of humane treatment of animals. Further, students can study at their own pace and when and where they want, providing they have access to a computer and internet connection. In addition, the inclusion of work assessments will give the students the means to review their study progress. Further, the use of a CMS based online platform will enable tutors to monitor and analyse individual student performance. Scheduled online exams can be implemented and content can be made available only after completion of special sections of the course content. The e-learning program will provide a standardised training approach, and the modular build will allow customised course offerings. Teaching modules may include interactive elements on the pharmacodynamics and pharmacokinetics of pharmaceutical compounds, the stages of anaesthesia or the assessment of pain and distress by video demonstrations. By including husbandry and basic principles of animal facilities such as hygiene, climate control and dietary needs of animals we hope to bring about a better understanding of operational procedures and involvement of animal technicians.

An additional focus will be to ensure that students will achieve a good understanding of the capacities and limitations of alternative methods. In that context the contribution of "Experimental Animal Work *online*" for the 3R's will be in the refinement and replacement of the use of animals in the training and education of students and scientific personnel.

This will eventually lead to a reduction of the use of animals in education and for training purposes.

### **Acknowledgment**

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### **References**

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