

Education

MyMiCROscope—Intelligent virtual microscopy in a blended learning model at Ulm University

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SUMMARY

The growing diversity among students and the rapid increase in new technologies entering the system of higher education, demand reconsideration of traditional learning methods. To improve the individual student's learning situation we developed and integrated a novel virtual microscope, MyMiCROscope, into a face-to-face approach for teaching microscopic anatomy. The intelligent virtual microscope has not only enabled self-directed learning of the students at their individual learning speed independent of time and place but also offered new possibilities to interact with the user because it implements systematic annotations accessible from different operational levels. Furthermore the alteration of a sole instructor-led course into a blended learning model resulted in a change of the learning behaviour of the students: group work and social interactions were facilitated.

The results of this study show the advantages that intelligent virtual microscopy incorporates for self-directed learning and that blended learning in undergraduate medical education is able to fulfil the individual needs of the students and support social interactions without disregarding practical skills.

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1. Introduction

The integration of face-to-face learning experiences with online experiences affiliating the strengths of traditional and modern learning settings is designated as blended learning (Driscoll, 2002; Garrison and Kanuka, 2004). Blended learning has been defined in a variety of ways in the current specialized literature (Driscoll, 2002; Fox, 2002; Kerres and De Witt, 2003; Garrison and Kanuka, 2004; Mortera-Gutierrez, 2006; Osguthorpe and Graham, 2003). According to Garrison and Kanuka (2004), it is important to understand, that “blended learning has to be distinguished from other forms of learning that incorporate online opportunities. The real test of blended learning is the effective integration of the two main components (face-to-face instruction and internet technology) such that we are not just adding on to the existing dominant approach or method”. Initial studies with blended learning have reported promising results. Student achievement and satisfaction have been equal to or superior to traditional courses (Dziuban et al., 2004). Blended approaches are able to improve learning out-

comes for students veritabily (Twigg, 2003; Garnham and Kaleta, 2002) and on average have higher success and lower withdrawal rates (Dziuban and Moskal, 2001; Dziuban et al., 2004; Twigg, 2003). Our major goal was to facilitate learning experiences and self-directed learning for medical students, therefore a blended learning model instead of an exclusive instructor-led approach to teach microscopic anatomy was introduced. This methodical change was performed in two steps: First, development of an intelligent virtual microscope, MyMiCROscope, and, second, reorganization of the traditional course of microscopic anatomy to implement the new e-learning tool. The development of an intelligent virtual microscope requires the identification of quality standards virtual microscopes must today exhibit (Harris et al., 2001; Glatz-Krieger et al., 2003, 2006; Merk et al., 2010; Paulsen et al., 2010 and references cited therein) and the specification of features essential to support learning outcomes. One of these features in MyMiCROscope is the implementation of “intelligent virtual slides”, defined as continuously zoomable, high quality pictures implementing important information given through systematic annotations, which are accessible from different operational levels.

The evaluation of MyMiCROscope supported a high acceptance of the blended learning model. A total of 97% of the volunteering students asserted that they would recommend MyMiCROscope and 94% would like to use it as self-directed e-learning tool for preparation for the first oral exam. Comments of the students endorse

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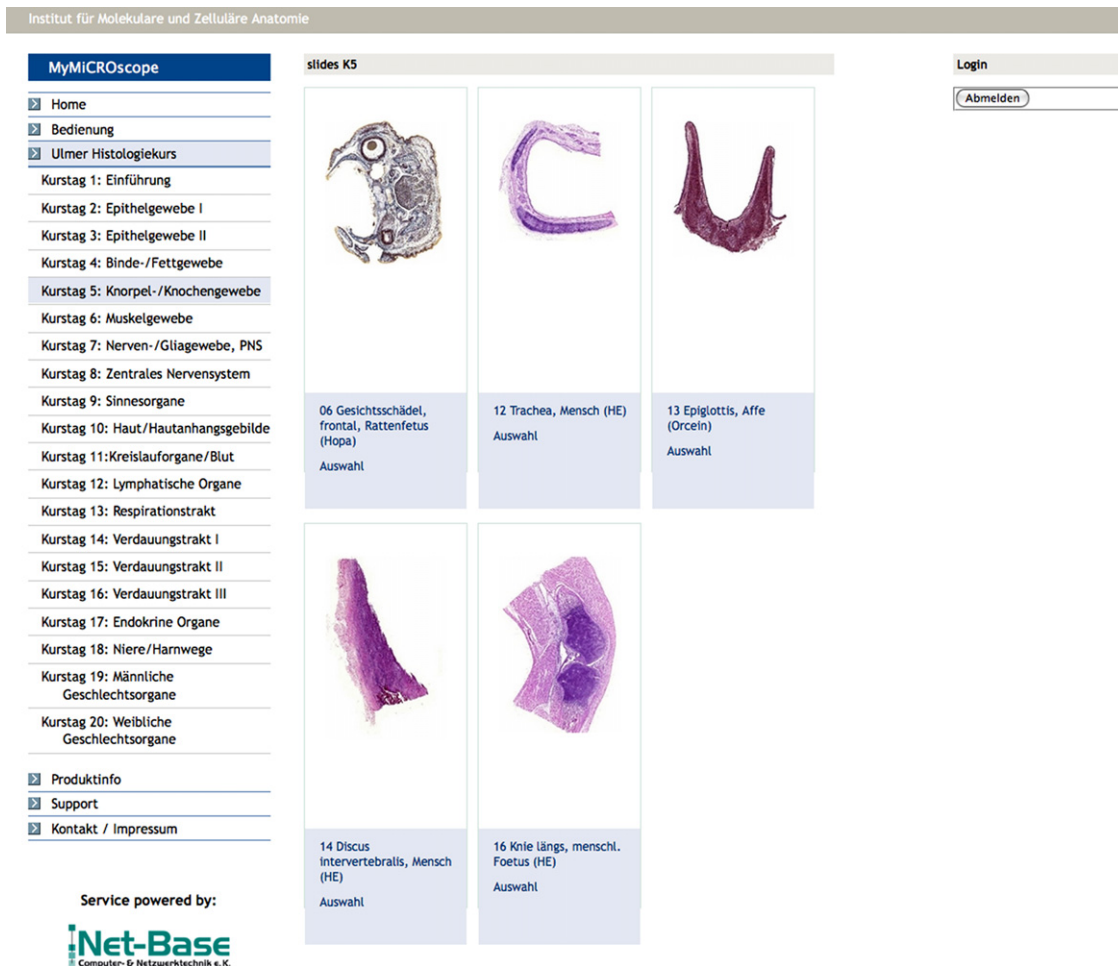


Fig. 1. Screenshot of the slide gallery view after choosing the fifth course day ("Kurstag 5") of the Ulmer histology course.

the fact that they do not want MyMiCROscope to replace the traditional instructor-led course where they use the light microscopes to examine the histological slides, but that they want it as an effective, motivating complement to the course, forming part of a blended-learning concept.

The present study supports the fact that the combination of instructor-led teaching methods in microscopic anatomy with intelligent virtual microscopy in a blended learning approach succeeds in fulfilling individual learning needs in higher education without losing professional skills.

2. Material and methods

2.1. Digitizing histological slides and system structure

Scans of the histological slides were taken using MIRAX MIDI (Carl Zeiss) with a Plan-Apochromat 20×/0.8 objective operated by MIRAX Control software. The virtual slides were converted into the sis-format (Arivis). Hosting and organization of the slides is adopted through the mirax@net-base platform (<http://www.net-base.de/Net-Base.1.0.html>) consisting of three major components: (1) the scalable, red hat based storage system comprises two redundant web-servers connected with two redundant load-balancers. (2) The LAMP-based, specifically adapted content management system (CMS; TYPO3) for the administration of the virtual slides. Additional slide-information and the user access-rights are stored

in a MySQL database. (3) The Apache-module for backend-rendering of the slides. A special javascript-framework is used to visualize the slides in web-browsers. This "webview" (Arivis) is partially controlled by the CMS using a special XML-based API. The virtual slides can be viewed with every up to date browser without further plugins.

2.2. User surface and content of MyMiCROscope (<http://mirax.net-base.de/UK-Ulm.mymi.0.html>)

After the password-restricted login the self-explanatory user surface of MyMiCROscope directs the user to the Ulmer course of microscopic anatomy. MyMiCROscope includes all histological slides of the Ulmer course of microscopic anatomy as intelligent virtual slides. Each course day is presented as a slide gallery view (Fig. 1). The single slide view offers a continuously zoomable, high-resolution picture with integrated systematic annotations. Annotations define visual designations of different shape and colour within a virtual slide and corresponding text information. The user is able to choose between showing and hiding single annotations/groups of annotations in the picture. In the single slide view the annotations in MyMiCROscope are additionally compiled as a list subdivided into three sections: organization, common and special annotations (Fig. 2). Choosing an annotation from the displayed list or within the intelligent virtual slide zooms the picture to the correct magnification, in which the annotation was made.

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