Julius-Maximilians-
UNIVERSITÄT WÜRZBURG

PiD
Lehrstuhl für Physik und ihre Didaktik

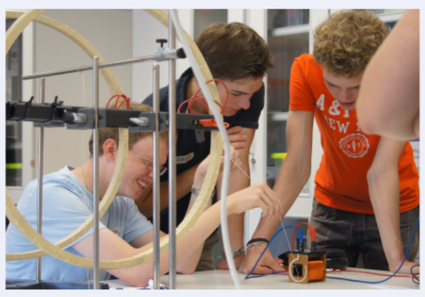
Digital Lab Manuals in Teaching-Learning-Labs

Frank Finkenberg, Thomas Trefzger
University of Würzburg, Germany

Teaching-Learning-Lab

Teaching-learning-labs at the M!ND-Center are part of pre-service science teachers' education at the University of Würzburg. In the physics departement, pre-service teachers design experimental stations based on the physics curriculum of secondary schools, e.g. for optics, electricity, biophysics. School students are then invited to explore the lab under supervision of pre-service teachers. Hence, the lab courses provide both teaching and learning opportunities.





Software Workflow

The digital lab manuals are created with the software Adobe Acrobat Pro®, sometimes after preparatory work with an office software. The pre-service teachers assemble text modules, pictures, photographs, animations, videos, and interactive elements within a standard layout. In the end, the PDF files are uploaded to the tablets.

Digital Lab Manuals

Pre-service teachers prepare PDF files as lab manuals for tablets. With them, school students are able to conduct the experiments on their own in pairs or small groups. While still under guidance of the pre-service teachers, the students use the tablets self-directed in different ways:

Lab Tutorial

- motivational and contextual slides
- photos and pictures of the experiment
- clues to performing the experiments
- step-by-step directions
- animated instructions

Guide Through the Lab

- organisational information
- methods for grouping the teams
- safety guidelines

Record Book

- drop-down lists
- multiple and single choice menus
- spreadsheets
- canvases for drawing diagrams
- free-text fields

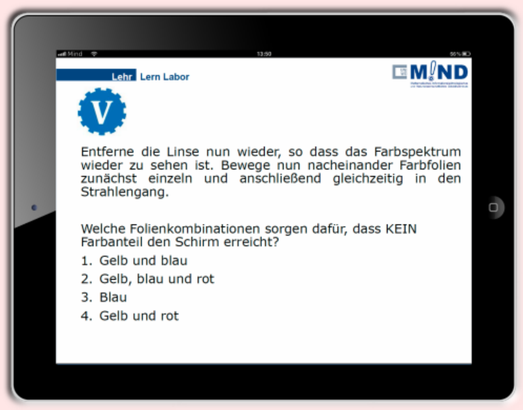
Work Book

- questions to be answered
- examining problems arising out of the experiment
- interactive tasks to apply newly aquired knowledge
- material for group discussions
- transfer activities

Source of Information

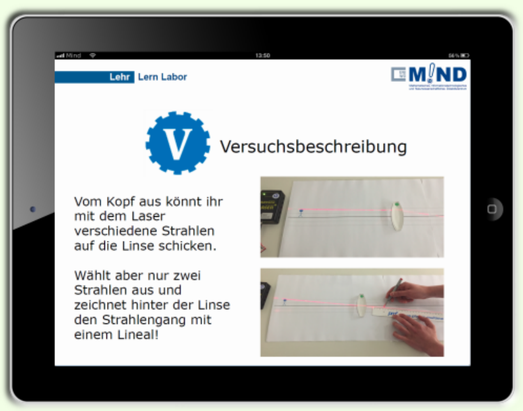
- pop-up notes with background informations
- hyperlinks to anchor marks, files or websites
- further video content
- context and application of the physics involved
- relevance to everyday life

Examples for Digital Lab Manuals



Bad Practice

- too much text
- not enough visualization
- no interactive elements
- no double coding
- not easy to grasp



Good Practice

+ combining different media types
+ interactive menus
+ small text portions
+ different ways of securing results
+ self-guided multimedia learning

First Experiences

- Workflow is smoother and more efficient than with paper manuals
- School students stay motivated and attentive for longer stretches of time
- Pre-service teachers need extensive training to create digital lab manuals

Next Steps

- Offering a better way for students to take their results home
- Server based infrastructure for digital lab manuals
- Special instructions for pre-service teachers to create multimedia content

Possible Research Objectives

- How much do **school students** benefit from using digital lab manuals instead of conventional paper manuals?
- How much do **pre-service teachers** improve their multimedia competence in teaching-learning-lab courses?

Literature

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Frank Finkenberg | Lehrstuhl für Physik und ihre Didaktik | Universität Würzburg | Emil-Hilb-Weg 22 | 97074 Würzburg | Zi. 22.00.12 | Tel. +49 931 31-86025 | frank.finkenberg@physik.uni-wuerzburg.de

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