Brave New Lab World

Electronic Lab Books Digitise Laboratory Documentation

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Heinrich Heine University Düsseldorf, Germany

Center for Information and Media Technology (ZIM)
1. Electronic Lab Notebooks
   • What is it?
   • ELN at HHU
   • Requirements
2. Examples from research & teaching
3. On-site support & Networking
4. Conclusion & Outlook
ELN – An introduction
RDM Competence Centre

https://fdm.hhu.de*

- Merger of ZIM, University Library and Research Promotion/Transfer Department
  - Regular jour-fixe since 2021

- RDM Steering Committee
- RDM Council

*(in the course of the year there will be adapted English websites)
ELN – what is it?

• ELN = An electronic lab book (or electronic laboratory notebook (ELN)) is a digitally created and maintained lab book that claims to replace a handwritten or printed laboratory notebook.

• Planning → Implementation → Evaluation (of scientific experiments)
ELN – what is it?

<table>
<thead>
<tr>
<th>Simple systems, „blank sheet“</th>
<th>Developed systems</th>
<th>Laboratory information management systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text entries</td>
<td>Special input aids, e.g. structural form editor</td>
<td>Sample management</td>
</tr>
<tr>
<td>Add files to notes</td>
<td>Rights management</td>
<td>Connection of devices</td>
</tr>
<tr>
<td>Attachments, e.g. pictures</td>
<td>Audit trail</td>
<td>Automated processes</td>
</tr>
<tr>
<td>Search in Text entries</td>
<td>API</td>
<td></td>
</tr>
<tr>
<td>Example: OneNote</td>
<td>Example: eLabFTW</td>
<td>Example: Limsophy</td>
</tr>
</tbody>
</table>

- **Criteria**
  - generic
  - web-based

ELN Guide of the ZBMED
https://www.publisso.de/forschungsdatenmanagement/fd-dokumentieren/

ELN at HHU

- Labfolder (commercial)
  - Since 2013
  - Chemistry/industry research project

- eLabFTW (open source)
  - Since 2018
  - Result from discussions with researchers
  - Use in chemistry, biology, physics & medicine
ELN at HHU

- eLabFTW (Open-Source)
  - Experiments
    - Freely definable status
    - Timestamp possible
    - Defining templates and steps
  - Database entries
    - Defining templates and subtypes
    - Usable for e.g. lab inventory, protocols
    - Definition bookable entries possible
  - Categorisation
    - Freely definable keywords (tags)
    - Defining dynamic fields
  - Booking of devices via integrated calendar
eLabFTW Surface

Brave New Lab World - Electronic Lab Books Digitise Laboratory Documentation

fdm.hhu.de
Make or Buy?

Contract with Deltablot

- Server operation On-Premises
  - + Service provider/expert at the back of your hand

- Open source funding

https://www.deltablot.com/
Requirements for an ELN

• Technical requirements
  • User-friendliness
  • Support known file formats
  • Availability
  • Exit strategies

• Functional requirements
  • e.g. Molecule Editor
  • Interface to specific programme (Matlab)

• Regulatory requirements
  • Good scientific practice
  • Security, integrity
  • Findability
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„Researchers must endeavour to carry out their investigations to the best of their knowledge and belief in accordance with the latest state of knowledge lege artis and to challenge all results with regard to plausibility.“

Extract from the "Regulations on the Principles for Ensuring Good Scientific Practice" (HHU)
Examples from research & teaching
User groups & practical examples

Teams: 89 – Researchers: 1373 – Experiments: 29.253 *

- Medicine: Preclinical
  - ELN as interface between QMS and digital storage of laboratory journals
  - Standard operating procedures (SOP) and managed biobank

- CRC1208: Membrane systems
  - Mandatory use
  - Automatic archiving in a repository via SOP structure

- Physics: Medical Physics
  - Protocol management via database
  - Group planner for devices & rooms

- Neurobiology: Teaching
  - Bachelor and Master course uses ELN
  - Creating tutorials together
  - Chemical database (400 entries)

*the status is from 06.06.23
Integration into the curriculum

Neurobiology Master Course

• „Cellular and molecular analysis of brain function“
• Working together on video tutorials (eLabFTW)
• First steps in flurometric imaging under laboratory conditions
  • Generate and evaluate data
• Optimisation for teaching purposes
  • Students develop templates, meaningful tags…

→ Early handling of ELN – faster and wider acceptance

→ Potentials for independent learning in the laboratory
Integration into the curriculum

Maturity process

- Lab
- Labbook
- Systematic Labbook
- Verifiable Systematic Labbook
- Optimization

Labwork → Documentation Paper → Templates Workflows Requirements → Timestamps Regular Evaluation Interfaces → Continuous Development Quality of Service Sustainability
On-site support & Networking
On-site support

HHU internal

- Together with researchers
  - Collected usecases
  - Monthly meetings with CRC / Cluster of Excellence (CEPLAS)
  - eLabFTW Usergroup 2020
    - Virtual event with >100 participants
  - Instance for teaching
    - Deletion of entries possible
  - Key figures for the use of eLabFTW
  - District government / genetic engineering documentation obligations
On-site support

Key figures on the use of services

- User eLabFTW
- Status is from 21.11.2022

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Employees</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts and Humanities</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Business Administration and Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Law</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics &amp; Natural Sciences</td>
<td>399</td>
<td>154</td>
</tr>
<tr>
<td>Medicine</td>
<td>236</td>
<td>50</td>
</tr>
</tbody>
</table>
Advanced electronic signature - Form-Z

- Genetic Engineering Recording Ordinance (GenTAufzV)
  - Document the path of genetically modified organism (GVO)
- Instructions for LTV Certificates
  - Checking a digital signature in a PDF
  - Signing a PDF in Adobe Acrobat
  - Must be Possible to verify signature at any time in the future – Long-Term Validation
Networking

Research data management in cooperation

- Project phase 2017-2019
  - HHU: Many conversations with researchers
- Cooperation Düsseldorf – Wuppertal – Siegen
- Simultaneous FDM.nrw networking
Networking

FDM.nrw Networking

- Working group for ELN (in NRW) founded – 2019
- Almost 40 different HEIs
- Topics among others:
  - Central authentication method
  - Use in teaching
  - IT security concept
  - GDPR
  - Staff council participation
  - Technical sub-working group (with exchange via chat)
Networking

OER.Digichem.nrw

• Video tutorials for
  • Students in self-study
  • Lectures as part of teaching
• Identify digital needs
• Creation of target group specific video tutorials (in LMS)
Conclusion & Outlook
Conclusion

eLabFTW at HHU

• Flexible application
  • Teaching, with many students
  • Individual requirements in research
    • Increased use of application interfaces

• Platform approach: still monolithic?
  • Synergies in overarching projects
  • Mandatory common (system) requirements

• Usergroup HHU
  • Intra-university exchange
  • Pick up/convince newcomers
Filing cabinet with laboratory book archive

- How does that look digitised?
Outlook

Project together with CRC1208 on archiving

- Division of labour between faculty and ZIM
  - Researcher creates tool to automatically generate relevant metadata from eLabFTW entry (LISTER*)
  - ZIM is developing a solution to supplement this metadata
    - Adaption of a DSpace instance (improved search option)
    - Transfer to S3 storage with additional metadata
- Laboratory book platform is relieved
- Good scientific practice

*https://doi.org/10.1101/2023.02.20.529231
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Thank you for the attention