Digital Notebooks - productivity tools for researchers

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On 15th and 16th of March 2018, two events dedicated to **Electronic Lab Notebooks (ELNs)** took place at TU Delft Library: "[Digital Notebooks - productivity tools for researchers](#)" and "[Digital Notebooks - how to provide solutions for researchers?](#)". The events were organized by the Research Data Services, TU Delft Library. Both events attracted a lot of attention nationally and internationally, and the tickets got quickly sold out. We were very happy to see the amount of interest in these events, and the inspiring discussions initiated by the participants. During my PhD study in molecular biology and genetics, I have always felt the need for a digital tool to manage my research data. Currently being the [Data Steward](#) at the TU Delft Faculties of [Applied Sciences](#) and [Mechanical, Maritime and Materials Engineering](#), my responsibility is to address the data management needs of the researchers at these faculties. Therefore, it was especially interesting for me to join these events and explore the currently available tools. Below is a report of the first day.

The need for digital notebooks

Many academic researchers use paper notebooks to document all sorts of experimental details ranging from date, purpose, methodology and raw/analyzed data to conclusions. The main problem with paper-based notebooks is that they are **not searchable**, especially considering that each researcher typically leaves behind a shelf full of such notebooks. As a result, it often becomes very difficult to find the results and details of experiments performed by previous lab members or even just to read and understand the related **handwritten notes**. Moreover, paper notebooks mostly could store only a printed copy of the finalized dataset, which is **not reusable**.

Furthermore, in a paper notebook, it is impossible to directly link the experimental details to all of the raw, intermediate and final datasets which are mostly digital. Together all of these do not only **decrease research efficiency** but also presents **challenges to research reproducibility**, which is a particularly important issue in the light of the current [reproducibility crisis](#) in science. Digital notebooks provide a **searchable** alternative to paper-based traditional notebooks, and additionally offer lots of **efficiency-saving integrations** - with various cloud storage platforms, calendars and project management tools.

Digital Notebooks - productivity tools for researchers on 15th of March

This full-day event was aimed at researchers, students, and supervisors who are interested in making their research digital, and research support staff who want to learn more about ELNs and how could ELNs meet the needs of the researchers. All of the presentations in this event can be found here: [DOI 10.5281/zenodo.1247390](https://doi.org/10.5281/zenodo.1247390).

Image from the [presentation](#) by Esther Maes

Esther Maes from [TU Delft Library](#) opened the event stressing the importance of archiving and that archiving is required not only to minimize the risk of losing data but also to avoid fraud. She continued with asking intriguing questions: **“What happens when you leave? How can people access the correct version of your data? Is it even easily accessible for you?”**

Then Alastair Dunning, the head of [TU Delft Research Data Services](#) and [4TU.Centre for Research Data](#), took the lead and emphasized that data documentation is a time-consuming process, involving many disjointed jumps such as experimenting, analyzing, indexing and publishing, therefore there is a need for making data documentation smoother. He finalized his speech with a valuable remark stating that **a new digital solution cannot have poorer usability than the existing paper ones.**

The rest of morning sessions focused on case studies from researchers who not only use digital notebooks in daily practice but also took the lead in the implementation of the ELNs in their research groups and institutes.

Images from the [presentation](#) by Alastair Dunning

Case study 1: Let's go digital; keeping track of your research using eLABJournal by Evelien Stouten from the Department of Biology, Utrecht University

Evelien Stouten described that the researchers expect an ELN to be not only **well-organized** and **searchable** but also suitable for **integration with other tools** and software packages, adding **literature references** and **data sharing** with collaborators. She also highlighted that an ELN is expected to provide **safe data storage** and be **fraud-proof**, meaning that everything that is documented remains **traceable**, even if it is deleted or changed.

Image from the [presentation](#) by Evelien Stouten

The Faculty of Science at Utrecht University started discussing ELNs in 2013 and the researchers were invited to take part in a test phase from 2014. Her research group found out that [eLABJournal](#) meets their expectations and provides an additional application suitable for their needs, namely [eLABInventory](#). This application enables **digital documentation and categorization of samples** such as strains, plasmids, cell lines, chemicals, antibodies, RNA

and DNA samples, and **linking** of these samples **to the experimental data**. She stressed that they are obligated by law to keep records of all genetically modified organisms (GMO) and usage of eLABInventory is currently obligatory for all Utrecht University labs using GMOs. She also mentioned that they find the **mobile app** useful since it enables the researchers to use eLABJournal also on their phones or tablets when they are working in the lab.

She concluded her talk by pointing out that some people are really attached to their paper lab journals and it might take some effort to convince them to start using it, even though it is made obligatory.

Case study 2: From paper to screen: What users really think about electronic lab notebooks by Katharina Hanika, Department of Plant Sciences, Wageningen University

Image from the [presentation](#) by Katharina Hanika

Katharina Hanika shared with the audience her experience with **eLABJournal** and her insights into using ELNs. She focused on why to switch from paper to screen by listing the pros and cons of ELNs. For pros, she indicated the **readable**, **structured** and **searchable** information, **digital storage of samples**, and **easy collaboration with colleagues** not only for sharing or discussing data but also for **version control**. As for cons, she pointed out that the **startup was time-intensive** since it takes time to figure out how the program works. Moreover, a **good internet connection** is required as eLABJournal is **web-based**. Although eLABJournal is **still under improvement**, she sees that as an advantage, since the company provides support and adjusts accordingly to needs of the researchers.

She further continued with discussing how to achieve department-wide implementation of ELNs. She suggested that it is best to **start with volunteers** since it is **challenging to convince the "creatures of habit" to change their ways of working**. She pointed out that if researchers try ELNs themselves, they can get frustrated and give up, and therefore it is a good idea to first **start with online demonstrations and hands-on exercises**. It would be also beneficial to assign the **experienced ELN users as contact persons** to be reached for questions. Moreover, creating an **ELN user group** would enable researchers to help each other.

She concluded her talk by stating that any (electronic) lab notebook is only as good as its user and what it takes is time, commitment and adaptability.

Case study 3: Enabling connectivity in electronic laboratory notekeeping – a pilot approach in biomedical sciences by Harald Kusch, University Medical Center Göttingen

Image from the [presentation](#) by Harald Kusch

Harald Kusch talked about the pilot implementation of [RSpace](#) at [CRC 1002 Research Data Platform](#). He highlighted that using an ELN enables **linking of experimental data** to other relevant elements, such as catalogs for **cell lines**, **mouse lines**, and **antibodies**, as well as **databases**. He explained the possible ways of structuring data in an ELN, which are **chronological**, **project-oriented** and **method-oriented**. Although it is a challenge to decide which is the best option, the chronological option is the only option in a paper lab journal. He described that RSpace allows both **structured** and **unstructured documentation**. Structured

documentation is very handy, especially for new people in the lab, as it allows using **centralized protocols** and facilitated **metadata recording**. Meanwhile, unstructured documentation offers room for creativity and is especially suitable for new lab protocols. He also stressed that all versions of each document are saved, which **prevents fraud**. He explained that the data can be exported in different formats, such as **PDF, HTML, and XML**. Moreover, RSpace offers interfaces for **easy transfer of datasets to data repositories** such as [Dataverse](#). He finalized his talk emphasizing that **start-up phase takes time**.

Interactive questions from the audience

During this interactive session, the audience had the chance to ask their questions to the presenters of the case studies. Most questions were focused on the following topics:

Where is the data stored? Is institutional data storage an option?

- Both **eLABJournal** and **RSpace** give the institutional data storage option to their users.

How to use an ELN in a lab environment without going up and down between the lab and the office to write down notes?

- Katharina: There are fixed tablets available in the lab, some people directly type in the tablet, some make handwritten notes and go back to their PCs.
- Harald: Not every lab can afford a tablet per lab member, but it may also not be necessary.
- Evelien: Not everyone types right away, some prefer to make small notes and then type it in the ELN in the office.

What happens to the added hyperlinks in the ELNs if folders are moved, do links work still?

- If the name or location is changed, the link would indeed break but at least it is possible to trace back to the previous link. There is no direct solution available yet.

Does setting up an ELN in a department need a fully dedicated staff member?

- To be able to implement an ELN, an ideal way would be that a lab member who knows the research type and needs takes the lead to implement it.

Keynote by Alastair Downie, University of Cambridge: Choosing an Electronic Lab Notebook

Alastair Downie told that the **first ELN came in 1997** and the **industry was quick to adopt**, while this was **not the case with academia**. He explained that the industry has a variety of incentives to use ELNs, such as the requirement for **absolutely consistent processes, protection of intellectual property** and other **commercial and corporate responsibilities**. He answered the question **"What is holding universities back?"** saying that there are so

many different types of ELNs and so many different types of research and research needs which altogether makes it difficult to find the ideal solution. To make it easier for the researchers to choose an ELN, he prepared a valuable [resource](#) with an overview of the available solutions. In this source, information about a variety of issues are provided:

- What is an electronic lab notebook and why should I use one?
- A note about DIY systems
- ELN vs LIMS
- Disengagement – what if I want to change systems?
- Narrowing the scope, creating a shortlist
- Evaluating ELN products
- Table of 25 current ELN products
- Discussion forum

As an alternative option to the available ELNs, he introduced **Do-It-Yourself (DIY) ELNs** which could be made by using tools such as [EVERNOTE](#), [OneNote](#), [asana](#), [Basecamp](#), [Dropbox](#), [OneDrive](#). He emphasized that using one of these tools as a DIY ELN still requires a very disciplined approach; however, without any ELN, one needs to be even more structured. He also stressed that these tools are not designed to be used as an ELN and therefore do not provide custom solutions.

Image from the [presentation](#) by Alastair Downie

He also focused on the question "What if you chose the wrong product?". It is possible that after implementing an ELN, the ELN software can change and may not be really suitable for the research needs of the users. If you stop using an ELN, in most cases all you can export is a PDF, HTML or XML file(s), but on the other hand at least such files are **easily accessible** and **searchable** and can be **backed-up** and **securely stored**.

Then he focused on creating a shortlist to find the ideal option:

- **Do you have a budget?**
 - Free or a paid ELN? Is a paid ELN worth the money?
- **Will you use the software as an individual or a group?**
 - Collaborative vs self-contained, comprehensive vs lightweight
- **Do you need team collaboration and supervisor features?**
 - Group activity dashboard, commenting & discussions
 - Constant discussion, even if the group leader is away
- **Departmental or institutional deployment?**
 - Please everyone? Or focus on stability, accessibility, and universal relevance?
- **Do you need multi-operating system (OS) compatibility?**
 - Browser-based & OS agnostic, or application-based
- **What devices will be used to operate the software?**
 - Tablets on bench? Voice recognition? Phones? Paper?
- **Data security and compliance requirements?**
 - GDPR compliance? Local storage?

He further explained how to evaluate the shortlisted products:

- **Interface design**
 - Look and feel user-friendly, intuitive and efficient?
- **Workflow suitability**
 - Does ELN workflow match your own workflow?
- **Content creation tools**
 - Writing, drawing, annotation, markup, equations, chemical structures...
- **Data management & storage features**
 - Upload typical file types/sizes? Larger files? Display/operation? Backed-up?
- **Integration with other software and/or cloud services**
 - Office apps, Statistics, Institutional storage, Community repositories...
- **Collaboration features**
 - Share data and comments in a group? Invite external collaboration?
- **Group leader/Supervisor features**
 - Sufficient oversight and feedback tools? Team/account management?
- **Export features**
 - Pages, sections, entire ELN? Data in original formats?

More detailed information can be found at: www.gurdon.cam.ac.uk/eln

Info from ELN providers about afternoon workshops

There were four ELN providers present at the event:

- [RSpace](#) - [presentation](#) by Richard Adams
- [eLABJournal](#) - [presentation](#) by Ulrike Dijkman, Florian Studener
- [labfolder](#) - [presentation](#) by Yannick Skop
- [Hivebench](#) - [presentation](#) by Wouter Haak and Julien Therier

Before the interactive demonstration sessions, each ELN provider was given the opportunity to give a pitch about their ELN product. The presentations in this session and the morning session can be found here: [DOI 10.5281/zenodo.1247390](https://doi.org/10.5281/zenodo.1247390).

Hands-on workshops and opportunity to test tools offered by various ELN providers

In this session, the participants were given the opportunity to try out the ELNs listed above and ask their questions directly to the providers. Here are the feedbacks that were given by the participants about each ELN at the end of the hands-on workshops:

What did you like the most about RSpace?

Mentimeter

A word cloud showing positive feedback for RSpace. The most prominent words are 'chemical app', 'structured', 'nice logo', 'full export', 'api', 'Link to repositories', 'export functionality', 'conn to oss repository', 'presented by a developer', 'links to external files', 'Simplicity', 'Intuitive interfacing', 'File view', 'tracking and tracing', and 'Tool integration'.

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What could be improved about RSpace?

Mentimeter

A word cloud showing areas for improvement for RSpace. The most prominent words are 'No tags', 'process atoms', and 'Larger team'.

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What did you like the most about eLabJournal?

Mentimeter

A word cloud showing positive feedback for eLabJournal. The most prominent words are 'Structure', 'Mobile version', 'Permission settings', 'Collaboration', 'Integrated file managem', 'Interaction with inventor', 'Timeline view', 'web editor', 'Interface', 'intuitive', 'Sample types', 'Calculations in protocol', and 'Clear interface'.

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What could be improved about eLabJournal?

Mentimeter

A word cloud showing areas for improvement for eLabJournal. The most prominent words are 'Confusing navigation', 'No agenda', 'Demo', 'No txt image mix', 'fieldwork difficult', and 'Structure'.

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What did you like the most about LabFolder?

Mentimeter

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What could be improved about LabFolder?

Mentimeter

7

What did you like the most about Hivebench?

Mentimeter

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What could be improved about Hivebench?

Mentimeter

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After this event, we got contacted by researchers from various TU Delft departments to discuss the possibilities of implementing an ELN. Currently, we are in contact with researchers to determine what they expect and require from an ELN and we are planning to start a pilot study afterwards.

I would like to finalize this report by sharing the feedbacks given by the participants about this event:

What is your overall rating of this event?

47 responses

Which organisation are you from?

47 responses

Acknowledgements:

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