

Keep calm and go paperless: Electronic lab notebooks can improve your research.





Postdoctoral researcher from the [Faculty of Civil Engineering and Geosciences](#), [Siân Jones](#), champions the use of electronic lab notebooks (ELNs) at TU Delft.

Physicist and [Data Champion](#), [Dr Siân Jones](#), has dedicated her research career to studying the [rheology of foam](#) at several European institutions. She currently works in the [Petroleum Engineering](#) section at TU Delft studying the industrial application of steam-foam floods at high temperatures and pressures for enhanced oil recovery. As an experienced bench scientist, Jones gives us her verdict on the use of electronic lab notebooks (ELNs) to promote good research data management and laboratory practice.

Problems with paper...

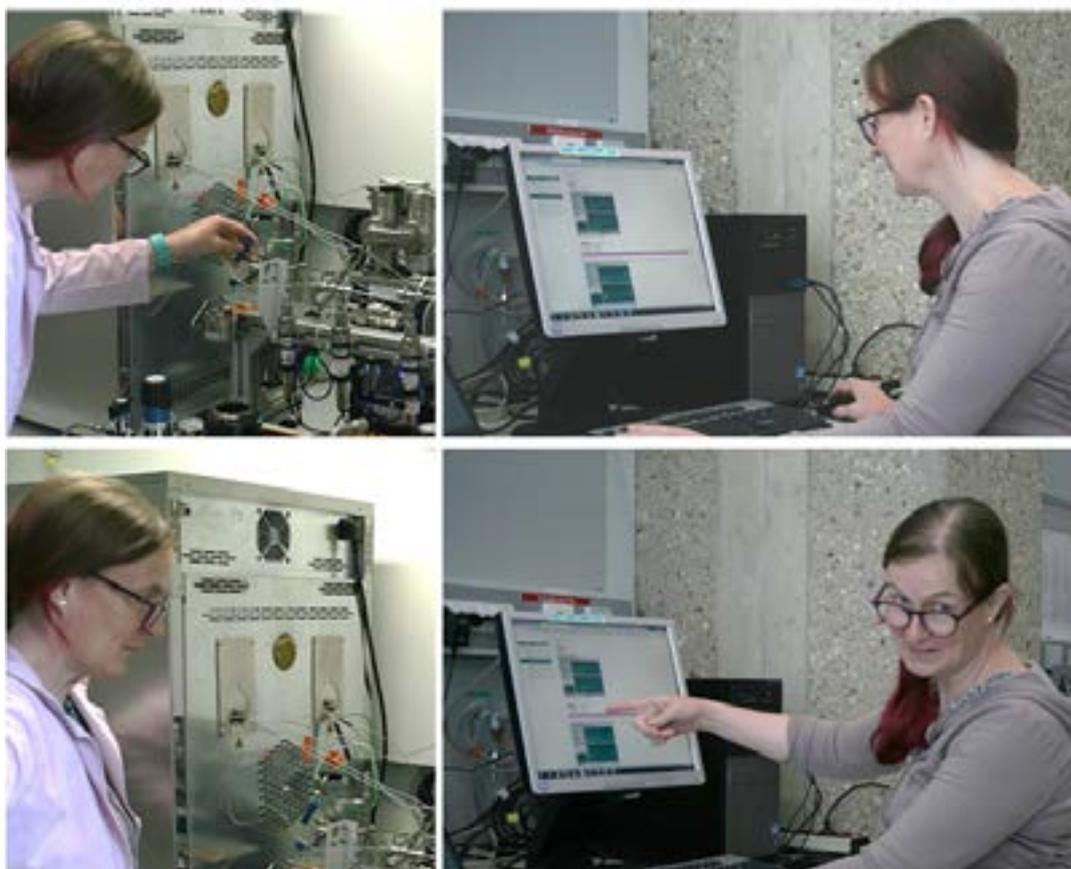
Life in academia can take a researcher from one short-term employment contract to another. As a researcher moves to the next institution, country or continent, it's important that they leave their data in a well-organised format that is secure and dependable for optimal knowledge exchange. "I've relocated for work on many occasions," says Jones. "Each time I've left an institution I've questioned the most effective way to archive my data to benefit my successors."

Jones recounts her frustration with relying on paper notebooks to record experiments. "It becomes problematic when you need to replicate experiments or continue a research project conducted by a researcher who has since left your institution without documenting their work properly." Jones identifies some difficulties of understanding handwritten information (including her own!) "Locating and interpreting data from past experiments can be challenging using paper notebooks," she admits. "Finally, after rifling through pages of scribbled diagrams, photocopies and post-it notes you find the experiment you've been searching for and it can be impossible to decipher the handwriting and bridge the gaps of missing information". These problems sound all too familiar to most lab-based scientists and have increased the demand for digital solutions, such as ELNs, that can improve the rigour, robustness and reproducibility of scientific research.

The electronic lab notebook

In its simplest form an ELN is a software system for documenting research work. Over time, they have evolved to become much more than a direct replacement for their paper ancestor, encompassing a range of additional features, including:

- A text editor for writing notes in a way that replicates a paper notebook
- Spreadsheet tools for calculations, and formatting tables and graphs
- Protocol templates for documenting standard procedures
- Laboratory inventories for documenting samples, reagents and apparatus
- Collaboration tools for sharing experimental information.



Caption: Jones demonstrates the use of an electronic lab notebook.

Based on Jones's experience of using various ELN software packages, including [BIOVIA](#), [labguru](#), [labfolder](#), [RSpace](#) and [eLABJOURNAL](#), we asked her to tell us why she advocates ditching the humble paper notebook to go digital. She explains how ELNs provide solutions to problems with paper by offering...

Structure (all of your data in one spot!)

Most ELNs have a user-friendly interface that allows the systematic input of data section-by-section.

Working with a digital template simplifies data curation and retains data in an organised structure in a single location. Plus, templates make it easier to create metadata for your experiments.

Bonus: Reusing digital templates for repetitive tasks, such as laboratory protocols, saves time and effort thereby maximising efficiency.

Searchability

Advanced search options mean users can retrieve information by 'author', 'tag', 'unique ID' and 'textual content' so that data can be located in seconds.

Bonus: You'll never need to worry about being able to read your own writing again!

Shareability

ELNs facilitate collaboration locally and globally by allowing users to share data. By encouraging open and transparent working, ELNs promote inclusivity as researchers can connect through the tool and extract the information they need. Some ELNs even have a live news feed to broadcast experimental results amongst laboratory group members!

Bonus: Technicians and PIs can offer their guidance, support and can track student progress. This is particularly useful when they are 'on-the-go' or away from the lab

Seamless integration

Most ELNs are accessed via a web-browser, which means they allow remote access from any location and are not restricted to one operating platform; several ELN providers have created apps to run their software on different device types (e.g. smartphones and tablets). Integration with web apps, such as [Microsoft Office](#), facilitates the quick and easy importation and exportation of research data. Moreover, ELNs are designed to connect with pre-existing [laboratory information management systems \(LIMS\)](#) for more effective data management.

Bonus: You can export your research data if you decide you want to disengage from a particular ELN software or if you want to switch to a new one.

Secure storage

Typically, ELN data is password-protected and backed-up to a cloud server for secure, long-term storage in compliance with good laboratory practice (GLP) guidelines, local data protection regulations (e.g. GDPR) and funding agency requirements. On-premises client-server installation is the most suitable option for institutions that must comply with strict IT policies to uphold data confidentiality. Electronic signatures allow for the validation of data integrity by authors and administrators. What's more, if all members of a research group use the same ELN software, it enforces a common language throughout the group which safeguards the body of information generated.

Bonus: Turn to a cloud-based solution to transform your disorganised stack of paper into a centralised data hub and you'll have more room in your filing cabinet and less lugging around of heavy lab books.

Implementing an ELN: Trials and training

The ELN market boasts considerable variety. [With more than 70 active products identified in 2017](#), the burgeoning array of choice can make it a challenging task to find the right ELN package for your research group. To avoid becoming overwhelmed by choice, Jones advises researchers to “only select two or three ELN packages to trial at any one time”. She highlights the difficulty of choosing a suitable ELN for deployment across all university departments, claiming that “there’s no one-size-fits-all solution. ELN designs are often tailored for use in specific research fields which can make choosing a suitable software highly subjective”. Most ELN vendors offer a free, cloud-based service for individual users, however, storage capacity may be limited and there’s minimal opportunity for collaboration with colleagues. Jones agrees that “ELNs are most valuable if all members of the research group use the same software”.

Once you’ve chosen your ELN, it’s important to provide adequate training for all users. “ELN software implementation takes time, commitment and adaptability,” says Jones. “It can be difficult to persuade established researchers to change old habits and start using ELNs but once it becomes common practice, the long-term benefits significantly outweigh the initial work investment.” As ELNs present a culture shock for some, for others it’s a welcomed change. Jones reveals that early career researchers, who have grown up in the digital age, tend to embrace electronic solutions and are eager to wave goodbye to their paper notebook.

Need more information?

For more information on the implementation of ELNs at TU Delft, you can read our blog post about the [library events that took place in March 2018](#) and our current [pilot project](#). Alternatively, you can talk to ELN enthusiast, [Dr. Siân Jones](#) or Data Steward and trials coordinator, [Esther Plomp](#). General information on the use of ELNs for improved research data management are provided by several other academic organisations, including [The Gurdon Institute](#) and [Harvard University](#).

Citation

This showcase is a selection from the following publication:

Clare, Connie. (2019). The Real World of Research Data [Book]. Zenodo. <http://doi.org/10.5281/zenodo.3584373>.

