

Labbook 2.0: Digital and Connected

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Fig. 1: Especially due to the increase in the number of mobile devices, digital laboratory ... [more](#)

The next generation of electronic lab notebooks is taking over the bench: In addition to a mobile usability, the collaboration between researchers is becoming more and more important. After the second wave of the digital revolution has reached everyday life with Web 2.0 innovations, it is now gradually taking over science.

Researchers benefit especially from new ways of scientific work and collaboration, which are offered by new platforms and fueled by cloud solutions and new collaborative tools.

Nonetheless, it remains remarkable that in spite of using the most modern equipment, most laboratories still rely on paper lab notebooks for planning and documenting scientific research: More than 70 % of all industrial laboratories and up to 96 % of all public research institutes still use paper-based documentation systems.

Paper Notebooks as Data Cemeteries

Many scientists know the frustrating feeling of not knowing whether the daily struggles they encounter with technical problems have not already been solved by someone else. And if trials which have been made already a year ago, have to be repeated all over again because it is impossible to decipher a colleague's handwriting, one thing becomes clear: traditional paper lab notebooks are a thing of the past.

The use of paper notebooks presents a fundamental structural problem particularly in the field of academic research. Data, which is documented on paper, is difficult to search or to communicate. While only a very small part of all data is communicated within a publication, most data remains hidden under the piles of files in the back of laboratories, where those findings are not even of use to the scientists who originally produced them. This massive loss of data is well known under the name of „File Drawer Effect“.

Electronic laboratory notebooks could be a viable solution here as they are able to record and archive scientific data in a digital format. Digital signatures to secure intellectual property are well-established these days and can completely replace an ordinary, handcrafted signature. One of the main advantages of paper-based notebooks is the fact that they can simply be taken anywhere.

However, since tablet computers have become affordable and almost everyone owns a smartphone, digital mobility is no longer a problem. But why are electronic lab notebooks not widely spread, despite all their advantages?

Increasing Digital Documentation in All Scientific Disciplines

Many scientists in the field of academia, in particular, are using combinations of text editor and spreadsheets for digital documentation processes, with mobile text editors like Evernote becoming more and more popular. Apart from the fact that the resulting loose collections of data are just as difficult to search as conventional paper notebooks, such notes hardly represent conclusive evidence in the case of patent disputes.

In general, digital lab notebooks are mainly found in the industry, but solutions for the academic market also exist which are affordable or even free of charge. However, what bothers researchers most is the fact that electronic lab notebooks demand their users to adapt their habits and structures to the software. Although the existing solutions help with the documentation process, they hardly exploit the potential to store data digitally. Therefore it became obvious to develop a digital laboratory notebook, which allows scientists to save their data using their own ways and data structures instead of having to adopt to standards imposed upon them by the system. In addition, there is a strong demand for software that uses the available digital data to actively assist scientists at the bench. The idea of Labfolder was born.

A strong trend in scientific data processing is the connection of software, equipment, platforms, scientific databases and services. The basis for this are open interfaces, so-called

APIs (Application Programming Interfaces) which enable the communication between equipment and computer programs. For example, it is also possible to link electronic lab notebooks with laboratory management systems (LIMS), which makes planning procedures and documentation even simpler.

The Digital Lab Notebooks Allows for new Ways of Collaboration

New platforms such as Mendeley, ResearchGate, Figshare and several others allow to exchange information away from the classic formats. This development is interesting for several reasons: For once, traditional publications only contain little technical information necessary to understand all the methods described. Another well-known problem is the lack of opportunity to describe negative results in those conventional publications. This leads to the frustrating situation that most experiments are being repeated all over again all across the globe. For those scientist, who want to publish their data the alternative way, an additional incentive has been created: Since the beginning of the year 2013, the National Science Foundation assesses scientists not only based on their publications, but also according to all data published in a format that allows for citations.

What Does this Mean for The Future of Electronic Lab Notebooks?

In times of scientific data linking, electronic lab notebooks will turn from mere documentation tools into a central platform for digital data management and scientific data processing. One of the objectives is to structure the already accumulated digital data and to make these findings available for further analysis.

Labfolder (it's free for individuals) is providing a tool that allows for the well structured storage of scientific reports and process information in order to find, compare and exchange process

information quick and easy as well as to use this information for the optimization of new processes in the future. This does not only benefit scientists, but rather facilitate the exchange of technical information in general. The future of digital laboratory notebooks has only just begun and researchers have the opportunity to participate in shaping this development more than ever before.

Authors:

Dr. Florian Hauer, Labfolder, FU Berlin, Berlin

Labfolder GmbH

Schönhauser Allee 6 /7

10119 Berlin

Tel: 030/91572642

Fax: 0176/24337833

Web: <http://www.labfolder.com/>

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