

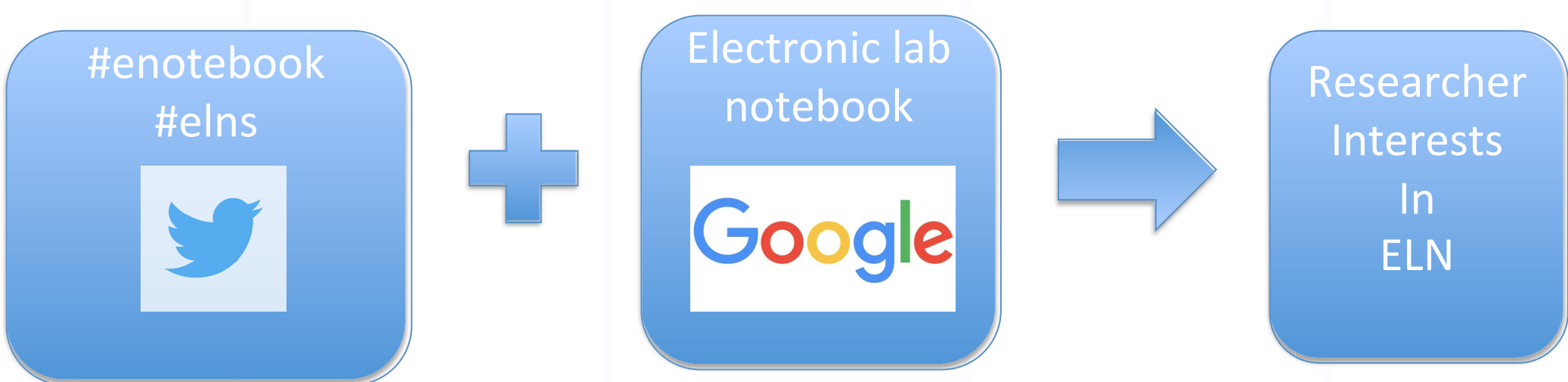
How Do Electronic Laboratory Notebooks Inspire Researchers?

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Objectives

This study explores if and how electronic laboratory notebook (ELN) platforms include features that may facilitate researchers in: collaborating; incorporating research literature in laboratory practices; or implementing best practices in research data management. It also looks to discover what other features are important to researchers when using an ELN.

Methods



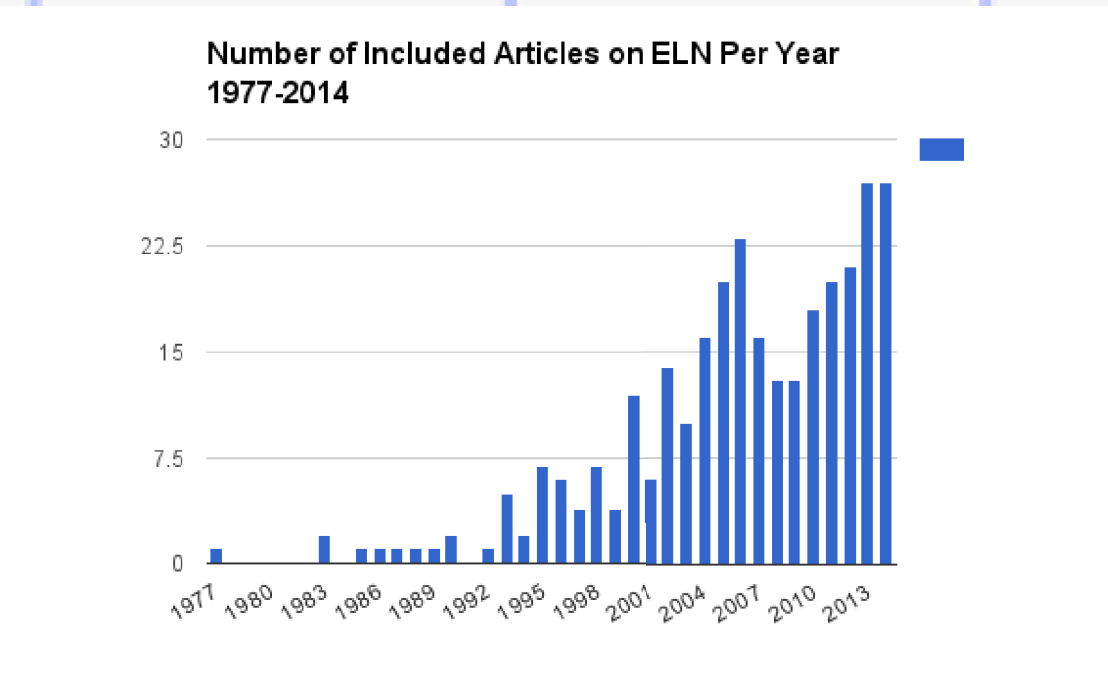
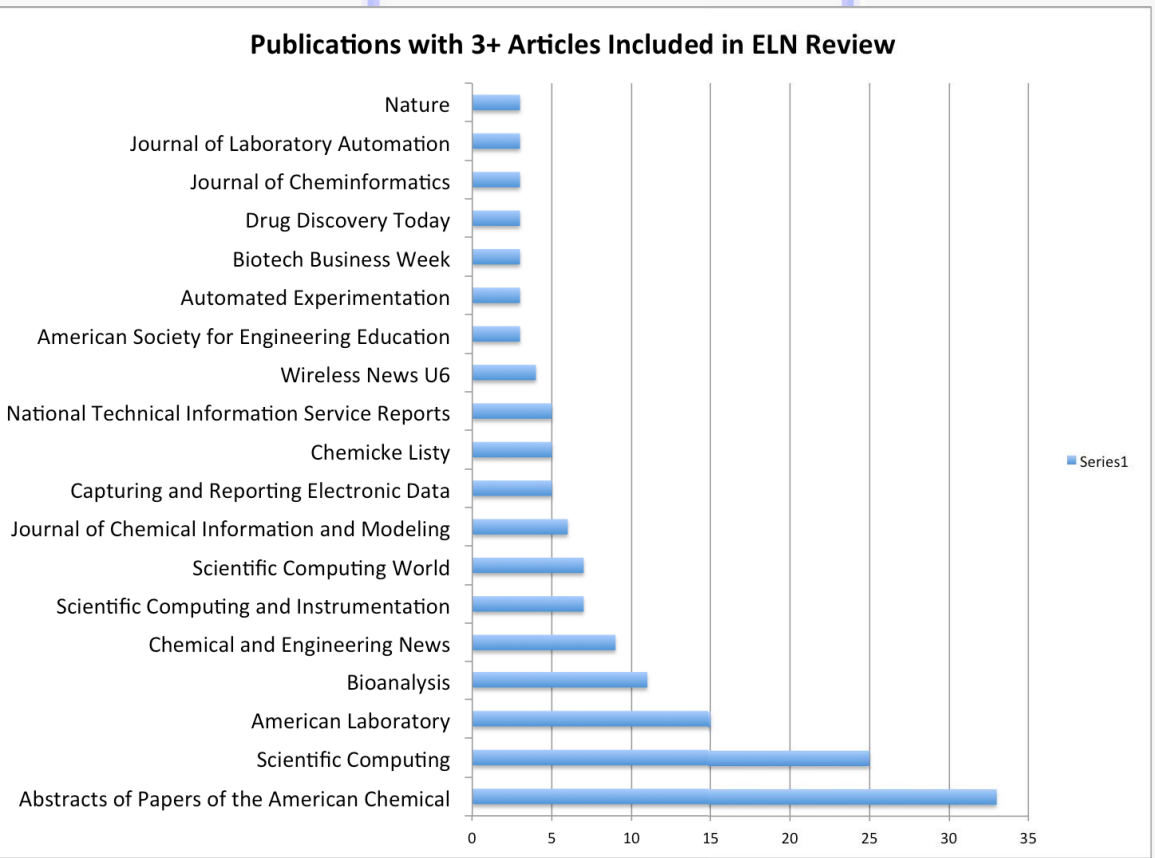
Electronic lab notebooks OR electronic lab notebook OR electronic laboratory notebooks OR electronic laboratory notebook OR e-notebook* OR eln platform

Title, Abstract, and Index terms

CINAHL 8	Engineering Village 275	IEEE Xplore 17	LISTA 10	PSYInfo 21	PubMed 68
Summon (VT Libraries) 142		Web of Science 187			

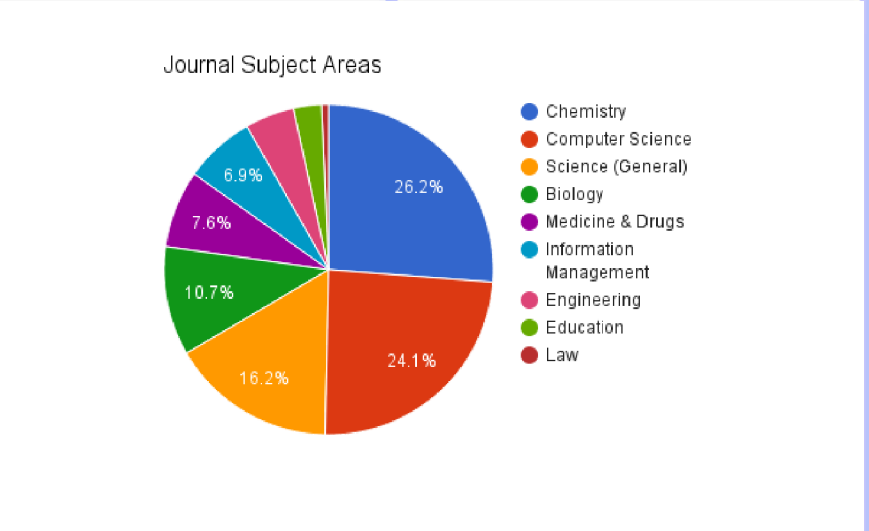
728 records – 281 duplicates – 135 excluded = 312 Literature Review records

Information Landscape



Terminology

In addition to search terms, related terminology includes: lab journals, lab e-journals, laboratory information systems (LIMS), SDMS (Scientific Data Management Systems), and ECM (Enterprise Content Management)



Themes

Research Data Management

Articles and online posts discussing ELN often refer directly to their benefits for best practices in research data management, including:

Full cycle **project management** and **organizational** features (templates for **data collection**, the ability to create a hierarchical, layered, or linked file structure), **searching** functions for later retrieval or analysis. **Integration with tools and software**, such as the ability to import data from instruments, equipment and sample management, and options to **analyze data** within the ELN, or by connecting with other interfaces or software are important. **Integration with data repositories** is mentioned, as is **metadata** – the ability to add one’s own, and inclusion of templates or recognized community standards. Also highlighted are features related to **Data Quality Control** or **Quality Assurance**, such as **version control**, **tracking changes**, and the ability to ‘freeze’ files or pages, to add an **e-signatures**, or to export an **audit trail**.

Metadata / Semantic Searching

A theme in ELN literature is the ability to add standardized metadata required by repositories or other entities is a useful feature. *For other cases, librarians may be able to assist researchers in developing project-specific metadata schema, or in identifying an existing schema to use. This includes all types of metadata, but in particular topical metadata / taxonomies / ontologies / nomenclature → to aid in consistent retrieval during and after the project.

Collaboration

Improved collaboration within one’s institution, between research institutions, such as with project partners, and for general purposes of sharing research processes, results, and data are all noted as features of interest and usefulness in ELNs. Two considerations discussed in relation to collaborative features are: 1) access methods – ELNs that allow for web access, mobile device access, and desktop access, and 2) Security and Permissions - while researchers desire options to collaborate and to share data, they also look for the ability to designate multiple permissions levels and are concerned about file and data security overall.

Research Literature

Research literature, its incorporation into lab research processes, documentation, and management is not discussed frequently. However, some articles do discuss the ability to link out to documents (such as research literature and protocols), and integration of major subject-area information resources, such as SciFinder for chemistry research ELNs.

Selected ELN Products

Product Name	Company	Free or Cost	Product Website	Subject Area	Academic or Industry
Academic / General					
CEIR Electronic Lab Notebook ELN (also eCAT and RSpace)	Lab-Ally	Cost	http://ceir-notebook.com/	Sciences in general	Academic or Industry
DocuLab	DocuLab	Free	http://www.doculab.com/	Sciences in general	Academic or Industry
EverNote	Evernote Corporation	Free / Premium version	https://evernote.com/	General - used by many as an ELN	General audience
iPython Notebook	iPython Development Team	Free	http://ipython.org/notebook.html	Sciences / Computational	Academic / IT
LabArchives	LabArchives	Free / Premium version	http://www.labarchives.com/	Sciences	Academic
Labguru	BioData	Cost	http://www.labguru.com/	Sciences	Academic or Industry
Labli	Labli	Free / Premium version	http://www.labli.com/	Sciences	Academic or Industry
LabTrove ELN	LabTrove	Free	http://www.labtrove.org/	Sciences	Academic or Industry
OneNote	Microsoft	Free / Premium version	https://www.onenote.com/	General - used by many as an ELN	General audience
Industry					
OpenLab	Agilent	Cost	https://www.agilent.com/en-us/products/openlab-software	Sciences	Industry or Academic
LabWare	LabWare	Cost	http://www.labware.com/en/products?product=LABWARE-SysC-Fig1000-JUL14	Sciences	Industry
CONNECTS for the Paperless Lab	Thermo Scientific	Cost	http://www.thermoscientific.com/connects-for-the-paperless-lab.html	Sciences - Specific products available	Industry
E-Notebook	CambridgeSoft	Cost	http://www.cambridgesoft.com/e-notebook.asp	Sciences - Specific products available	Industry
E-Workbook / Electronic Laboratory Notebook / E-Workbook for Biology	IDBS - ID Business Solutions	Cost	http://www.idbs.com/en/platform-products-workbook	Sciences - Specific products available	Industry
Electronic Laboratory Notebook	BOVIA (also Acefly)	Cost	http://acefly.com/products/ruffinlab-management/bovia-electronic-lab-notebooks/	Sciences - Specific products available	Industry
Elements	Perkins Elmer	Cost	https://elements.perkinelmer.com/roa-3800sg20e-c10-zinc-spectroscopy-powers-mvq	Sciences - Specific products available	Industry

Discussion

This review of ELN focuses on the perspectives of laboratory researchers in academic institutions, with inclusion of articles and view points from industry researchers. Key benefits of ELN platforms for academic researchers include increased productivity, support for Good Lab Practices and reproducibility of results. They also prioritize free or lower cost platforms and open source or flexible platforms that lend themselves to customization for tool and software integration, and for multi-disciplinary use. Platforms that can be used to collect, document and track, analyze, store, and create archival files for multiple data formats are important. The ability to collaborate with others, including permission-level settings and security for online data and file sharing is significant, as is support for overall project and lab management. Improved searching of data and files, including use of standardized or customized metadata is a benefit of ELNs, as is the ability to include links to or files for related resources, such as research literature and protocols. Concerns include loss or corruption of data and difficulty of using electronic devices in some lab environments. Industry researchers have a stronger focus on Quality Control, Quality Assurance, regulatory compliance features, and Intellectual Property claim support.

Limitations

This review began with a narrow understanding of the topic and thus the literature search did not include all terms that could be used. Also, coding would increase in effectiveness if conducted more than one time.

Next Steps

Further plans for this project include development of a survey to explore use of and interest in ELN at the author’s institution, with possible extension to other institutions – to further determine best avenues for library support in the use of ELN by students and researchers in the academic environment and in collaboration with industry.

References

Poster and References Handout – references discussing Themes and ELN products in VTechWorks, Virginia Tech institutional repository: <http://hdl.handle.net/10919/56951>
Zotero Group and Library of Electronic Laboratory Notebook review article citations
https://www.zotero.org/groups/electronic_laboratory_notebooks/items