Getting digital tools into students' and researchers' workflows

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Abstract

Students and researchers, especially in the natural sciences, benefit from an exponentially growing number of databases and informatics solutions, which facilitate the work with scientific information. However, at many universities, literacy is still viewed only in a subject-specific context. Therefore, databases and tools remain mostly underutilized. We believe that libraries must take the lead in teaching subject-independent information literacy, taking over an important role in educating the workforce of the digital future. By accepting this new role, libraries will develop into a skill center that seamlessly integrates into the research and teaching environment of a university. These new roles require also new skill sets of the library staff.

At ETH Zurich, the Chemistry | Biology | Pharmacy Information Center has successfully taken this new role and is teaching information literacy for chemistry, life sciences, pharmaceutical, materials and health sciences. We have also developed new formats for teaching information literacy that fit into ACRL’s Framework for Information Literacy for Higher Education. These new formats are “Coffee Lectures” and “Research Group Menu Card Seminars”. Coffee Lectures are 10-min-only shows on new tools, databases and services. This format has meanwhile been adopted by many universities in Germany and Switzerland. The seminars are based on a restaurant-like menu card and tailored to the needs of a single research group. Those two formats are accompanied by various case study courses and a 2014 newly designed 2 ECTS PhD Course entitled “Scientific Information Management in Chemistry and Life Sciences”. The course maps the research process to the process of information retrieval and management and includes e.g. text mining, or 2D and 3D visualization of molecules.

We report on our 4-year experience with the curriculum we developed, sharing our experiences and giving hands-on examples.

Key Words: Academic libraries, education and training, digital literacy, information literacy, educational formats, outreach, Framework for Information Literacy for Higher Education

Introduction

The core task of libraries, the sophisticated cataloging for retrieval of printed material, is less and less appreciated by students and researchers. As a result, the long-lasting relationship between users and libraries has been broken. Many users consider a library a place they frequently visited in the past, as it was very important, with sweet memories, but not as a place to go back. Thus, scientific libraries are looking for new roles, since making scientific content findable – in terms of journal and book articles – is now also done by publishers, by open and free services, such as Google or Digital Science with Dimensions – just to name a few.
Students and researchers believe they managed the transition into the digital age by collecting and reading PDFs instead of paper copies. And also scientific libraries believe that they have managed this transition by going from a place where scientific information was accessible during opening hours for students and researchers into a virtual place, where scientific information is provided digitally 24/7 to all students and researchers that are eligible to access the resources.

However, especially in the data-driven sciences such as chemistry and biology there are meanwhile numerous tools, databases as well as features of published information that most students and researchers are unaware of, as a recent investigation shows [Kramer & Bosman, 2016]. Interestingly, there are not many publications on the extent to which students and researchers are acquainted with the databases and tools provided by the scientific libraries – probably, as no library wants to report that their licensed tools are underutilized.

As todays possibilities for retrieving, analyzing and managing scientific information – and data – are underutilized someone has to do something about it. We believe that academic libraries should take this task and role, as we consider it a subsequent continuation of their earlier roles. Corporate scientific libraries underwent this transformation in the past, and found new roles – or were closed [Renn et. al, 2012].

Therefore, if one continues to think of libraries as enablers of the use of accumulated scientific knowledge, libraries have to take a step forward and turn into skill centers for fostering digital literacy, and for using information and communication technology (ICT). This means not only that new skills are expected from students and researchers; they are required from the library staff too. Libraries must be able to provide consulting to students and researchers, which can be delivered only by personnel that has both, a scientific qualification in the particular scientific field as well as IT skills.

**Scientific libraries as a fourth place**

In addition, new formats are needed to ensure that the knowledge transfer from the skill center “library” to students and researchers is done efficiently and effectively. This requires that libraries’ information consultants, the “enablers”, are up-to-date in their subject-specific research area as well as in terms of information technology developments. If they fulfill those requirements, they can successfully do the scouting and the careful evaluation of the frequently upcoming new possibilities for information and knowledge retrieval and management tools. This is what we consider to be a very important role for libraries, if not the most important one. A library is then not only a third place, as described by Oldenburg [Oldenburg,1989] but a fourth place, a skill center that, based on professional scouting and evaluation, enables researchers in the digital age to fully utilize scientific information.

In our opinion, a scientific library should strive for being a partner in Higher Education and to teach digital literacy in a broader sense, in addition to the subject-specific knowledge provided by the faculty. Note that this does not only anticipate tasks such as citation trainings, showing how to build bibliographies or how to use reference management systems. It means much more!

If a university aims to provide world-class education and research and strives to educate excellent scientists for both academia and industry, teaching digital literacy – which is a life-long learning task – is a must.
Developing a curriculum for Information Literacy

As a library within the ETH Zurich – one that made a change in libraries’ roles visible in its name already many years ago – we feel obliged to support the education of students and the life-long-learning process on new tools and technologies for researchers. This is particularly important for us as our unit is not a part of the ETH Library but a function of two departments, namely Chemistry and Applied Biosciences as well as Biology, which provide our funding. Showing the return on investment is, therefore, crucial for us.

In early 2013 we have analyzed the needs of students and researchers in the two departments – met, unmet and needs they are not even aware of. Also, we have analyzed the current level of digital literacy. Based on the results of the survey we have then developed a curriculum and various educational formats that cover e.g. the requirements of the first-year students as well as e.g. the needs of established professors and research groups [Renn & Dolenc, 2016].

When developing our curriculum for undergraduate students we matched it with their developing subject-specific knowledge until their graduation. In case of researchers, we developed the educational formats by analyzing the information needs in each step of their research process, e.g. we analyzed typical workflows of PhD students and postdocs in chemistry, life science and material sciences. This way we successfully developed a framework for education and training as well as measures and tools to raise awareness for digital information solutions.

Getting digital tools into the workflow by raising awareness

Dynamic modules for finding tools and databases
Most libraries present their licensed databases as A to Z list on their web site, sometimes even by using the cryptic acronyms of the databases only. It is unlikely that students and researchers will click on such acronyms to explore an unknown tool. To make it easier for students and researchers to find the right tool and database we have developed dynamic modules for databases and tools for our website. The users can drill down to find a selection of best databases by searching in an A to Z list (short and extended databases descriptions can be searched), by selecting the type of database or tool and by filtering by subject areas – up to two levels – and/or research question (Figure 1).

Infozine
Raising awareness for today’s possibilities is done through a serial, a magazine called Infozine – The Magazine for users of Scientific Information, which we publish infrequently and which is pushed to all members of the departments (staff and graduate students but not Bachelor and Master students) by e-mail with a link for download. Infozine is written in an entertaining style, and reports on new tools, databases, but also on developments in publishing and science communication. It has also many tips and tricks that can be applied in private life too. A very special column is the Infozine interview, where a student is interviewed by using always the same set of six questions. Infozine is published both in German and English and is freely available and open for subscription (e-mail alerts for new issues) also to third parties (Figure 2).

In addition, Infozine Special Issues are published to take up recent developments and topics. An example is the Special issue on “Research Metrics: For better or worse?”, that is freely available through ETH Zurich’s Research Collection or our website.
Figure 1. Screenshot of the dynamic module “databases” on our website www.infozentrum.ethz.ch. The module “Tools” has similar functionalities.

Figure 2. Two sample pages of Infozine.
**Infocus**

As Infozine is tailored for a heterogeneous user group, information on new tools, databases, software or events that are of interest only to small groups cannot be published in it. In order to be able to disseminate also that kind of very specific news we have created a personalized news alert, **Infocus**, which provides very focused information based on user profiles. In order to receive Infocus news alerts, users must register with an ETH Zurich e-mail address (the service is limited to the members of ETH Zurich) and tick their fields of interest on the newsletter’s website. Thus, in case of news that are too specific for Infozine, we map that news alert onto Infocus categories. If there is a match with profiles subscribed by our users, they will receive an e-mail alert in our corporate design (Figure 3).

![Example of an Infocus newsletter](image)

**Figure 3.** Example of an Infocus newsletter.

Infozine and Infocus are two services that are aimed to raise awareness for new tools, databases, software, services and events that users can eventually explore and further discover on their own.

**Coffee Lectures**

However, there are often new tools or services that deserve or need a more personal introduction or even hands-on demonstration such that potential users can realize their benefit. For this purpose, we have developed the Coffee Lectures format, which combines both the awareness and the training approach. Coffee Lectures have been invented and introduced already in 2007 by one of the authors (OR) in a corporate setting and were adopted to the needs of academia at the Chemistry | Biology | Pharmacy Information Center in 2013 [Renn, 2014]. Since then, more than 40 universities have taken up that format, particularly in Germany, Austria and Switzerland. A first user meeting for German-language countries has been held in April 2018 at KIT Karlsruhe and a website has been made available for exchange ([https://blogs.ethz.ch/coffeelectures/](https://blogs.ethz.ch/coffeelectures/)).
Coffee Lectures take into account that users do not have much time and are no longer willing to use databases or tools that require reading a handbook or undergoing a long training. Thus, Coffee Lectures are limited to 10 minutes only and are performed in an entertaining style. We usually have three-week periods of Coffee Lectures, which are held every Tuesday, Wednesday and Thursday from 13:00 to 13:10. Of course, there is always time for an informal discussion afterwards but the lecture itself is a time investment of 10 minutes only.

Today, we have more than 60 different coffee-lecture topics that range from subject-specific databases and software to broader topics that are relevant to researchers and students, such as e.g. social networks for scientists, predatory publishers, visualization, basics in design, research communication. A full list of topics can be found on our website [www.infozentrum.ethz.ch](http://www.infozentrum.ethz.ch) under Services > Education & Training.

We want our clients to come to the Coffee Lectures, as both them and we benefit from personal interaction and subsequent discussions. Thus, we do not upload slide decks or make any other information available. However, each attendee can get a Coffee Lectures Collector’s Card where basic information is summarized (Figure 4).

![Coffee Lectures](image)

Figure 4. Example of two Coffee Lectures Collectors Cards.
Coffee Lectures are not only given by staff of the Chemistry | Biology | Pharmacy Information Center but also by external guests, e.g. publishers, journalists or PhD students, who want to share their favorite tools, or have even developed a tool they want to advertise, such as the app apoc, for learning named reaction in chemistry (see Figure 4).

Getting digital tools into the workflow through training

Research Group Seminars Menu Cards
Another format we have developed are the Research Group Seminars Menu Cards. The idea behind this format is that getting into a training program is easier and more likely if it is obviously enjoyable. Instead of providing possible training courses as a simple list, we introduced menu cards like those you can find in a restaurant (Figure 5).

As from a menu card in a restaurant, research groups can select an information meal consisting of several courses, ranging from starters to a dessert. The selected menu of a research group is discussed with a representative of the research group or the Principal Investigator and is very much adopted to a research groups needs and their research questions and, thus, requires usually quite some time for preparation.

Occasionally, we do come across information retrieval and management needs, to which we have no immediate answer and where we have to search for possible solutions, either with existing tools, open source tools or licensed tools.

Training through third parties
Occasionally, we also invite third parties, e.g. vendors, companies or professionals to give a training session on certain topics for our students, especially for Master and PhD students, such
as proper use of statistics, on the chemistry information tool Reaxys or on drug development (Figure 6). If such as training is provided by a vendor, we make sure that it is not a marketing campaign.

Figure 6. Examples of two training sessions.

Getting digital tools into the workflow through educational formats

The Chemistry | Biology | Pharmacy Information Center has a privilege to participate in many mandatory courses, especially in the fall semester. These are usually practical courses, where we have assigned slots to give training on specific databases, tools and skills. The courses start already with the first-year students, who receive basic training on why scientific information is important. The lecture is entertaining and we e.g. explain the contents of a scientific article by generating a fake one and thus introducing Critical Thinking for the very first time. Students in the third semester receive constitutive training, and this continues also for Master students. Particularly important in our curriculum is the course we have developed for PhD students.

PhD Course Scientific Information Retrieval and Management in the Life Sciences and Chemistry

This course has been developed for PhD students in 2014, as we recognized a need for educating PhD students that often come from other universities and did not undergo our extensive training program that is part of the curriculum for Bachelor and Master students. The course was developed particularly for PhD students from Zurich Life Science Graduate School (and is thus open also to students from the University of Zurich) and for the students in chemistry and materials sciences. Meanwhile, we also attract students from the health sciences.

The course, which is taught every fall semester, maps the research cycle of PhD students – something already first-year PhD students are familiar with even if they have not yet published a paper. The course consists of twelve 90-minutes units, which cover all steps of the research process as described in Figure 7 below.
Figure 7. The typical research process mapped onto information retrieval and management processes.

The first out of the twelve units, a double unit, is the introduction into the world of scientific communication and publishing, and is laying the foundation for the following units:

1. The world of scientific publishing I: Basics, publishing models
2. The world of scientific publishing II. Recent and future developments
3. Searching and retrieving scientific information using search engines and literature databases
4. Searching and retrieving scientific information using subject-specific databases in chemistry and material science
5. Searching and retrieving scientific information using subject-specific databases in life sciences
6. Tools for analyzing scientific information
7. Tools for managing scientific information and sharing knowledge, including pipelining tools
8. Patents
9. Text (literature) and data mining
10. Visualizing molecules in 2D and 3D for lab reports, presentations, posters, and publications
11. Scientific writing, good design & good scientific practice
12. Communicating & analyzing the impact of (your) science

Whenever possible, we integrate practical examples and hand-on sessions into the units, where students have to use the tools we just presented to solve small problems. This gives us immediate feedback on how the classroom training – which is often in form of live demos – was received.

When following the lecture on text and data mining, students have a trial access to a professional text mining software, i.e. I2E from Linguamatics, which is the market leader for life sciences and is used in all major pharmaceutical companies. This includes access to a preconfigured server that is already loaded with an appropriate content, e.g. PubMed data. Based on the initial training – including fundamentals on text mining – they received in the course unit, PhD students can then explore their research questions with I2E for a limited time period.
Furthermore, unit 10 – visualization of molecules – is accompanied by a workshop in cooperation with the Student Project House, a makerspace where there are several 3D printers available. In this lecture, they learn how to render their molecule to prepare stunning images for publications (2D and 3D) or how to prepare the data for 3D printing.

At the end of the course, the PhD students need to do one out of three tasks: Either they describe a database or tool that we should add to our website or they write a short essay on their still unmet information needs, or on how their information needs have finally been met, due to taking the course.

This is an important feedback for us, as we get aware of the tools and databases PhD students are using. Or we learn about unmet needs and we consider possible, new solutions, also in cooperation with publishers and other vendors. Finally, a feedback on met information needs is very valuable too as we learn about the positive effects of our training, or about features of tools the students consider important – sometimes indeed to our surprise. A few general comments from PhD students are shown below:

- Will make the difference during my life as PhD student and during my future career
- Hands-on sessions, entertaining real-world examples
- How little things can change your PhD life
- The concepts introduced (...) about retrieval of information, text mining, scientific writing and about different databases help in every stage of a doctoral program
- It was extremely valuable to have guidance from experts who showed in great detail how to actively use a tool
- Rather astonished by the amount of functions I never heard about

**Advertising the Outreach Activities**

The amount of advertisement needed to get students to Coffee Lectures, Research Group Menus Seminars and the non-mandatory courses should not be underestimated. To advertise the Coffee Lectures, we use many channels: social media, such as Instagram, Facebook and Twitter, including accounts from students’ organization, if possible, events calendar from ETH Zurich, our website, e-mails with a flyer summarizing the contents of each series, and posters in hallways and elevators, which turn out to be very effective. In addition, we prepare short entertaining advertisement videos that run in the shuttle busses between the two ETH Zurich campuses and in selected buildings, and which are uploaded as well to our Instagram and Twitter sites.

Research Group Menus Seminars are advertised mainly by sending out hardcopies of the menu cards to Research Group Heads, i.e. Principal Investigators.

Advertisement for the PhD course is done by word of mouth, due to recommendations from former students who enrolled into the course and suggest it to fellow researchers. Nevertheless, we need to send out an e-mail reminder to all PhD Students of the departments of Chemistry and Applied Biosciences, Biology, Materials Science and Health Sciences shortly before the fall semester begins. If we miss that, enrollment numbers stay low. Once the e-mail is sent, numbers usually increase by 500%. In addition, we prepared a video that is available on YouTube (Figure 8), which advertises the course in an amusing style. We have prepared a similar video for the launch of the Coffee Lectures. Both videos have been produced by a graduate student from the Zurich University of the Arts.

When we introduced the PhD course in 2014, 15 students enrolled. Four years later, due to its constant growth, 75 students enrolled.
Figure 8: Screenshot of the video “Information savvy – with Course 529-0195-00” (https://youtu.be/R_4UpKMpMQ8). A similar video has been prepared for the launch of the Coffee Lectures (https://youtu.be/pioJPo-IPAo).

The Framework for Information Literacy for Higher Education

All outreach activities that we discussed are based on face-to-face interactions. Coffee Lectures, Research Group Menu Card Seminars and Courses are the three major approaches we use to transform our library into a skill center that enables our students and researchers to efficiently and effectively use scientific information. Furthermore, these are also our approaches to bring the ACRL's Framework for Information Literacy for Higher Education into practice [ACRL, 2016]. Our educational activities do not focus on “How to do it” but rather ask “Why should I do it?”. This is in alignment with ETH Zurich’s Critical Thinking Initiative that aims to foster the abilities and preserve the possibilities we need in order to take reasoned decisions and distinguish the good from the bad. It starts with reading and ends with cooking – or vice versa.

References

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