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The best practices for LIS education: embed in scientific research lifecycle

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Abstract:

Purpose—*During LIS education, we pay more attention to internships, practicums, field experiences, and mentorships which play important roles in preparing students to be competitive in the search for the first professional position and to be prepared to succeed in the position. And we are looking for more chances and best practices for it.*

Meanwhile, supporting scientific research is becoming one of the most important services in university libraries. Scientific research has experienced dramatic changes which are closely related to the library studies and practices. Generally, the research lifecycle is considered to contain four main elements: idea discovery, proposal writing, research process and publication, we can actively combine LIS education and library services with each of them in order to practice internships, practicums, field experiences, and mentorships for us, to promote scientific development for researchers, and most of all within these LIS educational programs may be learned from the various approaches to these learning opportunities. In this paper, research how to better integrate the LIS education into scientific research activities, practice our students and meet the needs of the researchers.

Design/methodology/approach—*Through in-depth interviews, we analysed the LIS education goals and researchers' needs in the scientific research lifecycle, and construct a LIS education and library service model that can be practically integrated into the entire research life cycle. By trying to apply the model to research activities in school of mathematical sciences in Peking University, we demonstrate the necessity and significance of combining LIS education with scientific research life cycles.*

Findings—*LIS education can be inserted in the scientific research life cycles successfully. It is critical that students or future librarians are engaged in the researchers' activities so that they can train their own abilities.*

Originality/value—*Peking University Library has created a new LIS education and library service model that described the LIS education contents and students' roles in research lifecycles, and apply it to practice to verify its validity.*

Keywords: LIS education, University libraries, Research lifecycle, Research model.

1 Introduction

In order to meet the needs of the society for information management talents, LIS education is constantly changing and innovating, one important aspect is to strengthen students' practical abilities. We pay more attention to internships, practicums, field experiences, and mentorships which play important roles in preparing students to be competitive in the search for the first professional position and to be prepared to succeed in the position. And we are looking for more chances and best practices for it.

1.1 LIS education and scientific academic research

Scientific academic research has experienced dramatic changes, and become more process-flow oriented, data intensive and collaborative, which are closely related to the library services. Actually, the librarians have been involved in the process of scientific research activities, and acquired some experience. Pang bei (**2012**) found the librarian's role has already been transformed to the extent that it is much more integral to the work of the researchers, and required to provide support at each stage of research cycles. Rodwell and Fairbairn (**2008**) foresaw the librarian are not only involved from the beginning of a research process, but also "even move to a higher level, with a stronger outward focus as an equal professional partner in the research, learning functions". Ina Fourie (**2012**) reported on a service model for a manageable research cycle which was pioneered at the Central Cancer Library of the Netherlands Cancer Institute (Amsterdam). Wang xue (**2014**) analyzed the subject information demand of users at different stages of scientific research, and tried to construct subject service model for scientific research by taking the example of services for Northeast Institute of Geography and Agroecology Chinese Academy of Science.

Some institutes and experts tend to focus on parts of abilities or working in collaboration to launch such a special educational program. The Council on Library and Information Resources/Digital Library Federation (CLIR/DLF) Data Curation Fellowship Program (**2013**) is an expansion of CLIR's Postdoctoral Fellowship Program in Academic Libraries. It now provides PhDs with professional development, education, and training opportunities in data curation for the sciences and social sciences, as well as for medieval studies. Harris-Pierce and Liu (**2012**) surveyed the web sites of 52 LIS schools in North America to identify data curation courses. These results indicated that LIS education are beginning to respond to the demand for scientific research, they need to add more such practices to their curriculum and continue to work collaboratively with the research institutes to determine the optimal course objectives and learning outcomes.

In summary, the current research sets up the foundation for the further research on embedding LIS education in scientific research lifecycle. However, there is still a substantial lack of comprehensive analysis of contents for embedding LIS education in scientific research cycle. In our opinion, LIS education can make students have the opportunity to come into contact with the scientific researchers, to integrate the students' practical activities into the academic research activities. During this process, LIS students would need a basic understanding of scientific research lifecycle to effectively understand and meet the needs of their clients——researchers; analysed the different aspects of the work in different stages; improve their knowledge of various kinds of information sources and planning; and carry out targeted preparation and practice.

1.2 Model for the research lifecycle

According to JISC (Figure1), the research lifecycle is generally considered to contain four main elements: idea discovery, proposal writing, research process and publication (**JISC, 2016**).

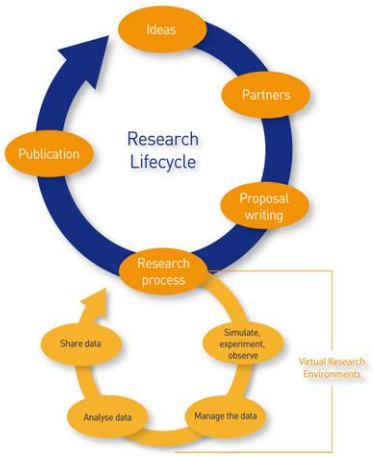


Figure1 Model of JISC research Lifecycle

2 Research methods

2.1 Data Sources

In order to fully understand the needs of scientific research process, we interviewed with the researchers in the school of mathematics sciences in Peking University. The interviews were designed to test the value of the model and gain insights on how to effectively deploy the model. Specifically, these topics were covered in interviews: purpose for using information to complete the daily tasks, purpose for using the library, information resources used for completing daily tasks, type of information required, service supports required from the library, potential collaboration with librarians, problems and benefits experienced with use of the library, and suggestions for addressing the problems. Participants were also prompted to comment on needs for access to information resources, tools for organizing information, an information supportive infrastructure, and discussion of other issues concerned. (**Liu shu, 2017**)

2.2 Model for LIS education embedded in research lifecycle

Researchers have different needs during research lifecycle and services or work to be done by our students are different accordingly. With personnel and technical means, libraries should construct a service model that works in the research lifecycle, ranging from service content, service time to other service aspects while students participate in the whole process to exercise all the abilities. We analysed the goal and detailed contents of the LIS education during the scientific research lifecycle, and constructed a “LIS education & scientific research” model (Figure2) that can be practically integrated into the entire research lifecycle.

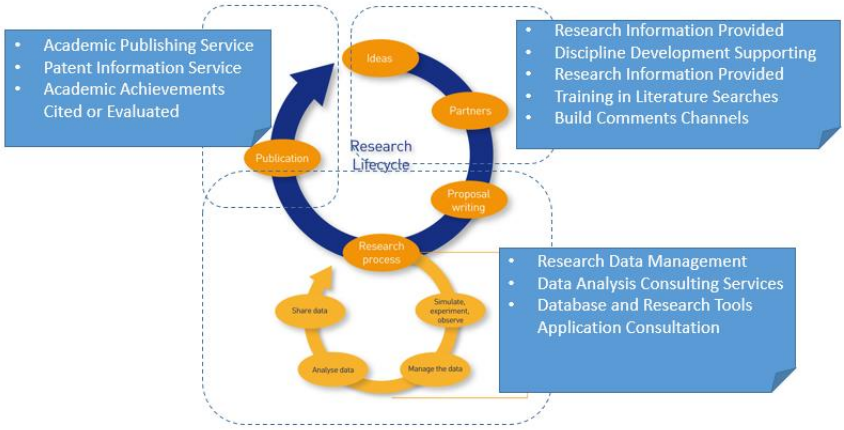


Figure2 Model of LIS education and scientific research lifecycle

Obviously it helps students to ascertain the depth and breadth of the services they provide if they are fully familiar with the activities they are engaged in. We have produced a comprehensive research lifecycle model that described the students' roles. The researchers' needs and corresponding students' practical goals in the lifecycle may be required as the following table:

Table1 Researchers' needs and corresponding students' practical goals

Scientific research lifecycle	**Needs of researchers**	**Practical goals for students**
Idea discovery	Initial literature collection; Research front analysis; Subject competitive analysis; Information of grants and funding collection	Research method; Literature collection; Providing training in literature search and usage; Data statistics/analysis tools; Service platform: Twitter, FB and other social platforms
Proposal writing, Research process	Literature collection; Data management; Data analysis	Literature collection; Data management tools; Data analysis tools; Specialized databases or tools; Data statistics/analysis tools and consulting services
Publication	Paper writing; Publication consulting; Pattern consulting; institutional repositories	Publication knowledge; Patent tools; Institutional repositories; Citation databases

For example, about literature collection in the process of *idea discovery*, the researchers need start actively collecting resources. But with so many journals in the databases, how do they know which journal to start with? Do they target at high impact journals? Or are publications in any peer-reviewed journal in their fields adequate? So our students should learn how to choose and utilize databases and tools available to identify journal titles, their impact and rankings, and play a role in guiding researchers to make a decision on selecting the appropriate journals to meet their specific needs.

3 Findings and Analysis

Which kind of support is required by a researcher? This will depend on the discipline in which they are working. For researchers in science field, they prefer Twitter and digital repositories, but researchers in social science field will be less likely to use emerging technologies. A variety of issues were raised through embedding in the researching process. Our students can grasp the needs of researchers, clarify the type of service, find new service point, and provide innovative services. In the process of providing services, our students learn more and practice their abilities more. What would our students do in every process of the research lifecycle can be described as set forth below.

3. 1 LIS education for *Idea discovery*

In recent years, more and more librarians play a role of a teacher, a subject leader or a staff, who are collaborating with researchers. Based on this, our students have an opportunity to contact with the scientific researchers, and LIS education can integrate the students' practical activities into the academic research activities.

In the initial process of the research, research activities generally involve study design, literature collection and funding application. Through the survey, we found that the core needs of researchers in this process is to collect the outputs of the research group, check new achievements, build platform to share information in the group, collect resources and so on.

Therefore, the work that students can participate include research consultations, frequently asked questions (FAQs), deeper research guides such as dynamic interdisciplinary analysis, research trend and research front analysis, providing research information (paper documents, open access databases and other sources), document retrieval consultant, looking for potential research partner.

- Providing Research Information

The collections provided by university libraries, including foreign language books, foreign language periodicals, Chinese books, important conference papers, electronic resources and other important materials, allow researchers to follow up the domestic and international top/hot information, and to help them identify research projects, clarify research direction, improve work efficiency, and promote the process of the construction of disciplines.

As the service suppliers in the research process, students who involved in the process should acquaint with quantitative research methods which enables them to process and analysed research data scientifically, and possess an extensive understanding on scientific data sources which enables them to provide strong support for researchers by recommending comprehensive and reliable data sources. They not only count the number of documents, analysed the structure of document and its utilization, but also use knowledge of literature support to reveal weaknesses in the quality of collections, and optimize the structure of the collection. The value of the service is especially well captured in the following email from a researcher named Zhang Yan who is a vice professor in the school of psychology in Peking University: *APA is a very authoritative psychology database which department teacher's teaching and research largely depend on, so thanks for library purchased the database quickly and thanks for your work.* (Translated from Chinese).

- Discipline Development Supporting

Over the past several years, many research organizations have assessed the quality of higher education institutions around the world：QS World University Ranking's QS World

University Rankings 2016-2017, American International Center for Strategic Studies' *assessment of the strength of the world*, the Brookings Institution's *Northeast Asia survey*, East-West Center's *Asia-Pacific security outlook*, London's International Strategy Institute's *strategic assessment report*. Similarly, LIB education should pay more attention to the discipline development supporting, which is a new service in recent years in Chinese university libraries and supports the quality evaluation of special discipline for research groups. The main contents of practice for the students include being familiar with several databases, assessing instrument, tracking development of the research group and the opponents, providing dynamic track of new technologies, receiving the full text document, providing patent information related to disciplines, and so on (Figure3).

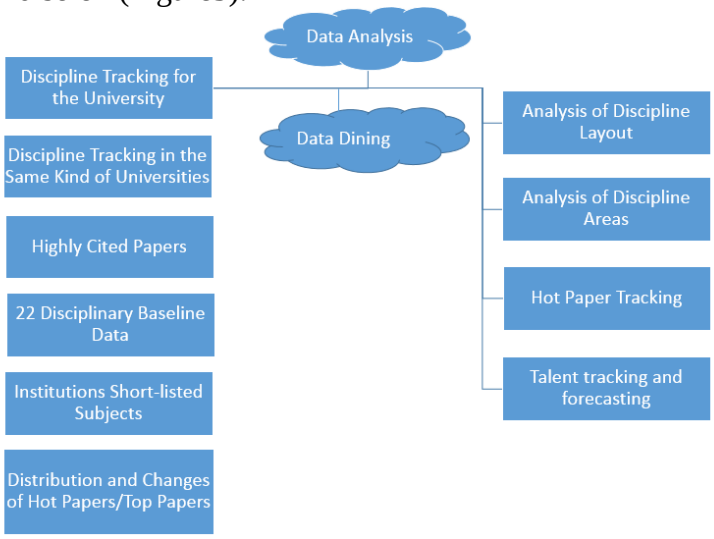


Figure3 Model for discipline development supporting

Decision supports, such as scientific assessments, discipline development, talent introduction and talent assessment, are important part of Chinese University discipline assessment. Therefore, students should become familiar with databases (for example, ESI, INCITES) and use them to mine top paper, analysed hot papers, provide personnel tracking, compare and monitor the discipline, and to study the frontier, mine special contribution of talent, track discipline competitiveness.

- Training in Literature Searches and usage

Give bread, it is better to give him hunting. During the research process, we can achieve documents for researchers. But actually researchers who felt confident about their search abilities ("We get acquainted with the field") remarked that "there is always a need for training", and the better the sooner. Students can give a systematic training include how to use the document management tools, special databases, professional books, laws and regulations related to the research and so on.

- Build Service Platform

Many libraries have constructed disciplinary service platform on which release and provide resources and services, librarians and researchers can perform two-way interaction and communication on it. LIS education students can focus the construction of the platform, reveal our resources and services on the platform which can be navigation to help researchers research, and even offer customization services for part of the researchers. Peking University Library are using the VIP® discipline service platform. (**Peking University Library discipline service platform**).

3. 2 LIS education for *Proposal writing, Research process*

Scientific research services provided in libraries mainly includes consultation and reference services for scientific research, instruction and training for researchers, compilation of working files about providing research information, collection, analysis and preservation of the research data. At this process, the needs of researchers are mainly divided into two parts, one is the accumulation and storage of experimental data and another is the demand of statistical analysis methods, software and resources.

For students, the work and practice includes data management, the usage of research tools, data analysis and so on. Library provides a rich variety of research tools and services for the researchers, such as data analysis tools, data management tools, even multimedia technology services. In addition, according to the needs of the research, students should know about international standard, patent data, even market information.

- Research Data curation

Scientific data includes both the original data acquired through scientific and technological activities such as experiments, observations, explorations, surveys or other ways and the various datasets formed through systematically processing and arrangement of original data. One of the major challenges faced by researchers is how to efficiently manage the explosive growth of scientific data and ensure the long-term preservation and effective management of scientific data for sharing and reusing in the future. So LIS education cultivate students to help researchers collect research data, save research data, build institutional repositories, provide text or data analysis tools, and provide files, data and other research data management services.

For example Cambridge University Library developed Institutional Repository DSpace Cambridge, researchers, teachers and students will share with others the results of various types of scientific information and the results of storage research papers, scientific data, image and multimedia information and other data on the internet conveniently. Peking University Library constructed the research data open platform to support research data management, storage and publishing, promote reusing and standardizing the data.

- Data Analysis

Teaching students how to offer consultation and reference services for scientific data curation is regarded as one of the core duties of LIS education. Data Analysis Consulting Services consist of two parts, on one hand, the students provide statistical analysis tools and platform, and carry out training in the use of these softwares. On the other hand, we help researchers understand the significance of scientific data curation and master the usage of various tools for data processing, data analysis and data statistics, etc.

For example researchers in school of Mathematics in Peking University wanted to master the distribution of the discipline of Topological accurately and rapidly, and grasp the development trend of the specific research topic, students analysed the research literatures on this discipline included the author, institutions, publication names, countries and research fronts, and retrieved the results of detailed analysis, revealed the current international research status, discussed the main research directions of the field by the means of WOS, Scopus, InCites, SciVal and other data analysis tools.

- Database and Research Tools Consultation

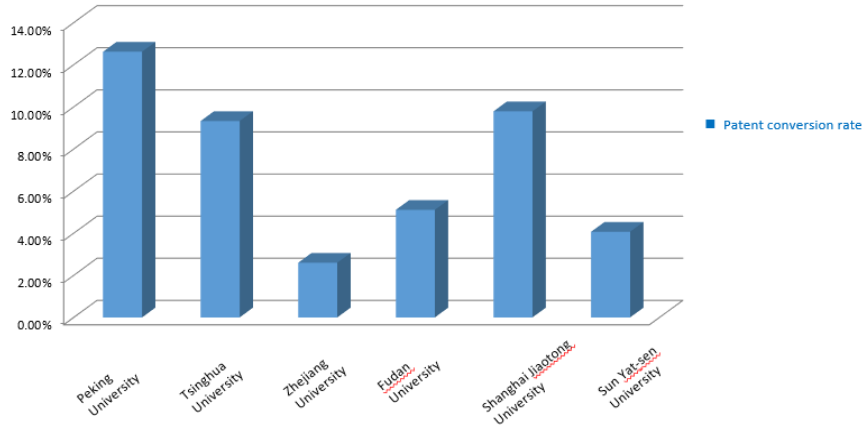
Research tools generally refer to computer software and network technology related to research including document management tools, information search tools, research aids, online learning platform, Open Access technology and so on. Chinese college and university libraries mostly provide SPSS statistical analysis, AutoCAD-aided design, ZineMaker, electronic books and Document management tools such as NoteExpress, RefWorks, Endnote and related training.

3. 3 LIS education for *Publication*

With the development of scientific research, scientific researches produce results in succession. According to users' feedback, at this process, most researchers need academic publishing services, patent information services, writing help and so on. Therefore, the students pay more attention services such as academic publishing, Open Access resources, copyright, Institutional Repository and other services for the purpose of publication and long-term preservation of scientific research results.

- Patent Information Service

More and more researchers need to apply for patents in the process of scientific research. Patent information service provided by the libraries is based on the patent literature which contains technical information, economic information and legal information. By using scientific tools and analysis methods, students learn to get access to the high technical and commercial value patent information, and use patent information to provide the information services for researchers. For example:



Figur4 Comparison of the patent conversion rate of 6 universities in China

Focusing on the conversion rate of the patent (patent conversion rate = numbers of patent / patent authorization numbers), Peking University, Tsinghua University, Zhejiang University, Fudan University, Shanghai Jiao Tong University, Sun Yat-sen University, the patent conversion rate were 12.62%, 9.33%, 2.60%, 5.11%, 9.79%, 4.07%(Figur4), Peking University has obvious advantages among them. (**Zhang chunhong, 2016**)

- Research Achievements Citation Retrieval Report

Researchers have higher demands for the analysis of citation retrieval of their research achievements, students can analysed the paper which was cited in the databases such as WOS 、SCOPUS 、CSCD 、CSSCI mainly by the means of the title, author's name, author's institution, publication year or other means, and create a Citation Retrieval Report as a result for researchers. At present, this kind of certificate reports are needed in many approvals or offers to valuate partly the ability of researchers.

- Writing help

At this process, some researchers need writing help. Students not only learn academic standard but also provide writing consultation, and give suggestion.

4 Conclusions

LIS education should pay more attention to students as future librarians embedding all-round services in the whole scientific research lifecycle.

This study identified the primary duties of LIS students as well as their required and preferred qualifications, making a content analysis of the scientific stages. Moreover, an overall picture of LIS education embedded in scientific research life cycle was presented in the paper. We attempted to explore whether students can acquiring the essential knowledge and skills for scientific research after they completed the process of services. The results showed that by embedding scientific research students acquired the basic knowledge and methods of scientific research, and issues such as the usage of data curation tools, the approaches for user training are also treated in the every stage, which are sometimes even more valued by the future employers. Services for scientific research also place more emphasis on training students communication and interpersonal skills. LIS education should closely combine with the future of library services, driving the construction of experiment course of LIS education, plays an important role in training students' practical ability and enhance their competitiveness.

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