Connecting the silos: Systematic data collection for library and collections assessment

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Assessment has gained greater prominence in library administration in the last decade. Whereas "library assessment" is associated with services, notably instructional or reference, collection assessment has evolved to its own specialty. The methods are largely quantitative and thus require extensive data sets, the management of which has required greater sophistication and technical expertise than in years past. Assessment, regardless of focus, is a data-intensive task. In order to make that judgment (of quality, meeting needs, educational attainment, etc.), evidence is needed. Bringing the data together in a manner that is effective and efficient has become a priority for organizations that need to assess on a regular basis. In this paper, I will describe the attempt we have made at The University of North Texas Libraries to organize data relevant for assessing our subject-based collections. This data are varied in formats, location, ownership, update frequency, and original purpose. I will present our most recent data model, our current methods of collecting, organizing, analyzing the data, and presenting results, as well as our plans for the future, which will include extending the reach of our connections.

Keywords: Library assessment, Library collections, Collection assessment, Databases, Database management.

1. Overview

Assessment is formally defined as "the action or instance of making a judgment about something" (Merriam-Webster, but emphasis added by author). Library assessment may therefore be the act of making a judgment of how well library services are meeting the needs of the community it serves. It is a concept that grew from the late 1990's with its emphasis on evaluating service quality and has matured as a discipline within the last ten years with the emergence of conferences (Library Assessment Conference, Evidence-based Library and Information Practice, and the Northumbrian Conference on Performance Measurement in Libraries and Information Services), journals, and textbooks. Indeed, the rate of growth of articles in the library and information sciences literature (as indexed in LISA and LIS Source, competing indexes) on the keyword phrase, "library assessment" exceeds that of overall articles indexed 3 to 1 (30% average annual growth rate of articles with keyword phrase, compared to 10% annual growth rate for all articles) (data available on request).

Collection assessment is a specialty of library assessment, with a focus on the judgment of meeting the community's needs through its collections. However, this has actually had a longer history than the more service-oriented library assessment. This concept can be traced through LIS literature back to the 1970's and 1980's, when there were several attempts to compare collections held by selected libraries. The initial peak of this phenomenon was in the late 1990's with the Conspectus movement, which was an attempt to systematically assess collections and rate them along lines of comprehensiveness, age, and scope. Interest in this labor-intensive project fell with the reduction of funds for libraries in the early 21st century, but the more general concept of collection assessment has picked up in recent years with the focus on effectiveness and efficiency (Johnson, 2009; Nisonger, 2003; Nisonger, 2005).

Assessment, regardless of focus, is a data-intensive task. In order to make that judgment (of quality, meeting needs, educational attainment, etc.), requiring evidence. Organizations that need to assess on a regular basis have made bringing the data together in a manner that is effective and efficient a priority (Blake & Schleper, 2004; Brown & Stowers, 2013; Steve Hiller & James Self, 2004). In this paper, I will describe the attempt we have made at The University of North Texas (UNT) Libraries to organize data relevant for assessing our subject-based collections. This data varies in formats, location, ownership, update frequency, and original purpose.

2. Literature Review

2.1. *Library assessment*

2.1.1. *Historical perspectives*

Initial measurements of libraries were focused solely on holdings and could be considered “of questionable value” (Thompson, 1951). It was not until the mid-nineteenth century that data about libraries began to extend beyond collections and into services. These early-modern reports originated in Europe in the form of directories of libraries that included statistics of not only total holdings, but acquisitions, circulation, and readership, but broadened to include expenditures, other forms of use, catalog sizes, and hours opened. In the United States, initial reports were similarly not much more than directories that were scant on details, with the data limited to total holdings and dates founded. Statistics of any real value only appeared in the twentieth century from the American Library Association (ALA) and the Association of College and

Research Libraries (ACRL). These reports eventually included not only total holdings, but acquisitions, expenditures, circulation, details of staffing, and salary expenditures. Thompson concludes his mid-century review of library measurement with the concerns of the day, notably the lack of uniformity of the measures, the inconsistency of reporting, and the poor accessibility of the data, which must be extracted from state or association annual reports. More relevant to this paper is his comment about how "relatively little (that) has been done to apply any but the most obvious statistical techniques for determining and describing their meaning (excepting, of course, special studies)" (Thompson, 1951).

2.1.2. *Accreditation and library standards*

Assessment of libraries, with the emphasis on "making a judgment", can be traced to the development of accreditation standards that was initiated late in the nineteenth century. The verbiage of accreditation standards has oscillated over time between the specific (e.g. a minimum number of holdings or staffing) to the vague (e.g. sufficient to support a program). Accreditation was developed largely because "those who earn credit want others to value it, (and) those who evaluate credit want to do so confidently". To fulfill this role of quality assurance in education, accrediting agencies establish standards, which indicate the "acceptable levels of quality" (Gaston, 2014).

While academic libraries themselves are not subject to separate accreditation, they and the services they provide are included in accreditation reviews of the parent institutions. The ACRL established and has maintained standards for college and university libraries for the explicit purpose of evaluation of libraries (ACRL, 1959; ACRL, 1979). A library that could demonstrate meeting these standards may be considered to be of some value to the institution it serves. Measurements mentioned above were often the bases for making these decisions, but as Thompson mentioned, not enough effort has been made to provide meaning to these measures, which may explain the fluctuation between specific values and vague statements of support.

2.1.3. *Value and impact assessment of libraries*

There have been more recent attempts to provide these meanings, largely resulting from the adoption of values and methods from the business sector. Niteki, Wiggins and Turner note the importance of the

paper by Lakos and Phipps in the dissemination of the concept of developing a "culture of assessment" in libraries. Indeed, the Association of Research Libraries' (ARL) LibQUAL+ survey is a direct application of the SERVQUAL instrument that was developed to measure service quality in businesses (Nitecki, Wiggins, & Turner, 2015).

Like Lakos and Phipps' work, Megan Oakleaf's Value of Academic Libraries serves as a catalyst of library assessment, having been cited over 200 times. Oakleaf synthesizes the disparate efforts of librarians and library scientists to measure the impact of the work of librarians and libraries as institutions on the outcomes of the people these librarians serve, thus filling that gap mentioned by Thompson of providing meaning to the measures, and then provides ideas for pursuing the next stage (Oakleaf, 2010).

2.2. *Collection assessment*

2.2.1. *Historical perspectives*

While collections have always been at the center of librarianship, the acquisition of materials for university libraries was limited largely to individual donations, with little consideration of broader implications (Johnson, 1999). In the history of modern librarianship, which dates back to the establishment of the American Library Association in 1876, librarians focused on the selection of books and materials, and not on developing collections, per se (Drury, 1930; Haines, 1935). Drury did advise conducting a needs assessment, which he called a "community analysis" as part of the selection process (Drury, 1930), which was continued by Haines, and included reviewing circulation records to identify the subjects of most interest to the library users. The emphasis, however, was on meeting these needs with quality materials, and thus librarians evaluated selection primarily by checking holdings against lists or bibliographies (Johnson, 2004). Peggy Johnson, who literally wrote the textbook on collection management and development (Johnson, 2004), noted that it was the dramatic increase in scholarly publication that arose after the world wars, combined with relatively slower growth of acquisitions budgets of academic libraries that led to the shift from selection to collection development. The difference between these concepts was in the broadening of the focus, from subject-specific to the whole collection, and from the needs of the individual patron to the needs of the university (Johnson, 1999).

This specialization in librarianship follows a spate of research that applied quantitative methods towards evaluation of collections, usually as a whole or as a

broad subject-based collection, comparing the size and expenditures of collections of academic libraries (Johnson, 2004). The most notable outcomes of this era were Allen Kent's analysis of the University of Pittsburgh library's collection that indicated only 60% of volumes were ever used (Schad et al., 1979), and Richard W. Trueswell's application of the Pareto Principle that 80% of the usage is of only 20% of the titles (Trueswell, 1969).

2.2.2. *Purposes of collection assessment*

Librarians evaluate their collections largely as an extension of overall library assessment. In early modern history of librarianship, the primary purpose of documenting data about the collection was to tout the size with the underlying assumption that size was a measure of quality. With the results of the bibliometric analyses started in the mid-twentieth century demonstrating limited use of these large collections, many stakeholders of academic libraries started to question this assumption. As accreditation requirements and library standards have become more relative rather than absolute, collection assessment has focused more on demonstrating the extent of meeting the needs of the students and the faculty.

2.2.3. *Methods of collection assessment*

The methods used by librarians to assess or evaluation collections, as described by Peggy Johnson, can be categorized in a matrix, re-created as Table 1. Quantitative methods are the more traditional methods, focusing on counts of resources, users, or usage. Relative measures, like circulations per title or per user, are better at determining impact or quality than absolute measures (e.g. total holdings or total circulations). Qualitative measures refer to measures of quality, and generally involve comparison of holdings with what the library should provide. The simplest of these methods is checking holdings against bibliographies or lists of titles from a known set of works, such as Choice's Outstanding Academic Titles. More recently, librarians have been attempting to compare their holdings with those of libraries at peer institutions. This is currently only possible using the OCLC Collection Evaluation System (CES), which uses the WorldCat system as its core database. WorldCat is the collective holdings of over 10,000 libraries worldwide (WorldCat.), and the CES allows librarians to compare their libraries' holdings at the title level with selected individual or groups of libraries. Brief Tests of Collection Strength is a similar list-checking method, whereby the list of titles are the most-held titles from a set of libraries (Beals & Gilmour, 2007; Twiss, 2001; White, 2008).

Table 1 Collection Assessment Methods (adapted from (Johnson, 2009)

	Resource-Based	**User-Based**
Quantitative	Descriptive statistics of holdings, acquisitions, expenditures	Descriptive statistics of users, usage (circulation and e-resource usage)
Qualitative	List-checking, peer comparisons, Brief Tests of Collection Strength	Interlibrary loan requests, evaluation surveys, critical-incident assessments of unmet needs

2.3. *Collection Mapping*

Collection mapping is a particular method of assessment that provides the subject librarians with a comprehensive understanding of the breadth and depth of the collections. Mary C. Bushing describes collection mapping as "a tool that enables libraries to graph collection strengths across disciplines and/or subjects", and which "provides statistical information and defines the broad character of a collection" (Bushing, 2006). The method is usually is subject-based, with the collections divided by pre-defined subjects, often patterned after the organizational structure of the parent institution. It is characterized as being systematic, with the same measures applied to different subjects so as to enable comparisons. The measures are selected based on the perception of objectivity and the ability to indicate a measure of quality. Collection mapping has been used by school librarians to generate scales of collection quality in a school district (Loertscher, 1985), as well as in academic libraries worldwide to gain an understanding of their collections (Hyödynmaa, Ahlholm-Kannisto, & Nurminen, 2010; Lumande & Ojedokun, 2005; Schmidt, 1989).

2.4. *Conspectus*

With the gross expansion of collections of academic libraries in the mid-twentieth century, librarians became aware that such growth was unsustainable, regarding the expenditures and the space required. Librarians became interested in developing collaborative collections based on local user needs and the sharing of resources. In the 1970's, the Research Libraries Group (RLG), a consortium of large research-oriented libraries, initiated an assessment of large numbers of collections nationwide. The purpose of their National Shelf List Count project was to provide a distribution of holdings of research libraries by subject. Collection development librarians within the RLG consortium developed a standard method of assessing collections, called the Conspectus, for the ultimate purpose of creating a consortial collection development policy. This would allow libraries the flexibility to focus their collections on meeting specific local needs, while reducing expenditures and efforts on meeting broader common needs.

The Conspectus approach involved a qualitative index (from "0" for "out of scope" to "5" for "comprehensive collecting"), as well as a detailed list of call number ranges representing subjects. The pilot project for this method was assessment of holdings on the broad subject of Asian history of a small set of libraries. The project reached its peak in the 1990's when it was adopted by OCLC, an international consortium of libraries which produces the largest collection of holdings records, known as WorldCat. From this acquisition, OCLC developed the Collection Analysis System (since renamed WorldShare Collection Evaluation System) in which librarians of subscribing libraries may analyze the library's holdings, as well as compare their holdings against peer libraries, by the same subject categories (Wood & Strauch, 1996).

2.5. *Data management*

Libraries have often been early adopters of office and communication technologies, from catalog cards and typewriters (New specialized typewriter.1937) and to Hollerith punch cards (Parker, 1936) to programmable typewriters (Electronic tape-activated typewriter used for automatic catalog card processing.1960) to desktop (Fosdick, 1980), laptops (Hensinger, 1988), and tablet computers (Williams, 2003). This is no less applicable to office software applications, including spreadsheet and relational database systems (Beiser, 1987). In current library organizations, the Microsoft Office Suite or its Open Access alternatives are ubiquitous, while the uptake of spreadsheets (Excel) for managing data exceeds that of relational database (Access). Both software applications, however, are used heavily by those who manage and/or analyze data

for collection evaluation or assessment purposes (Brown & Stowers, 2013; Harker & Klein, 2016).

Initial applications of desktop database management solutions were largely small-time versions of integrated library systems (ILS). These included inventory control, circulation, acquisitions, journal check-in management, and hold requests. Other applications were for essentially business operations, including human resources management (e.g. scheduling) and accounting. Some other library-specific applications included management of interlibrary loan requests and room reservations (Beiser, 1987; Butler, 1997).

Microsoft Office software programs are expensive yet still ubiquitous, due to extensive licensing to local governments and academic institutions. Librarians who do not have such access, however, were able to build similar applications with non-proprietary, or Open Source, solutions, notably MySQL and Google Sheets (the equivalent of Excel) (Breeding, 2007; Gardner & Pinfield, 2001; Simon, 2015). At the other end of the proprietary spectrum, some librarians developed solutions using the more robust (and expensive) Microsoft SQL Server database management system (Greene, 2008; Parrish, Schyndel, & Erdman, 2009).

3. Methods

3.1. *Collections Data Repository*

As with most libraries, data about our collections was limited in scope and depth, with most information embedded within the integrated library system (ILS) in the form of pre-scripted reports of holdings, expenditures, and circulations. Since 2012, this data has grown substantially but rather haphazardly, within silos constructed largely of spreadsheet files. To manage this data more effectively, we developed several databases using both MS SQL Server and MS Access. Further complicating this picture is the addition of "data dashboards" created using Tableau Public. The result of this haphazard growth was collection of unconnected silos of data, as represented by .

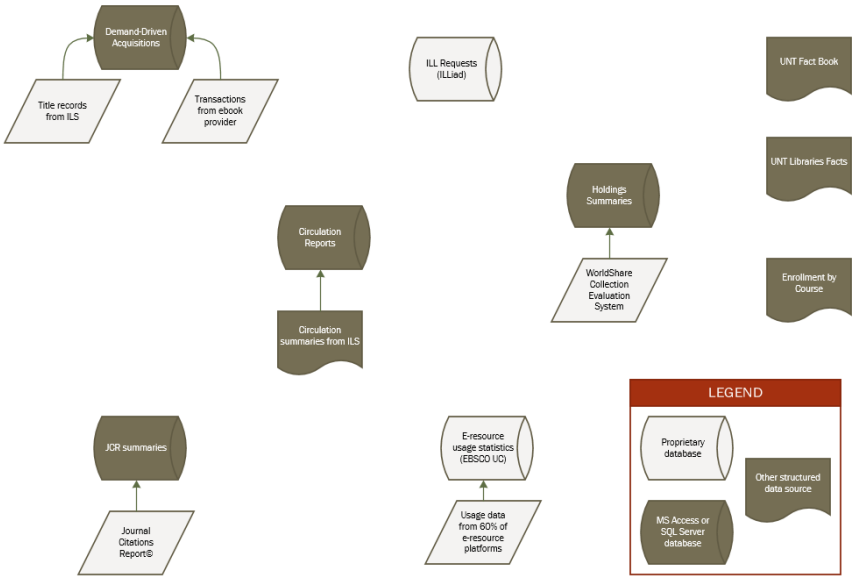


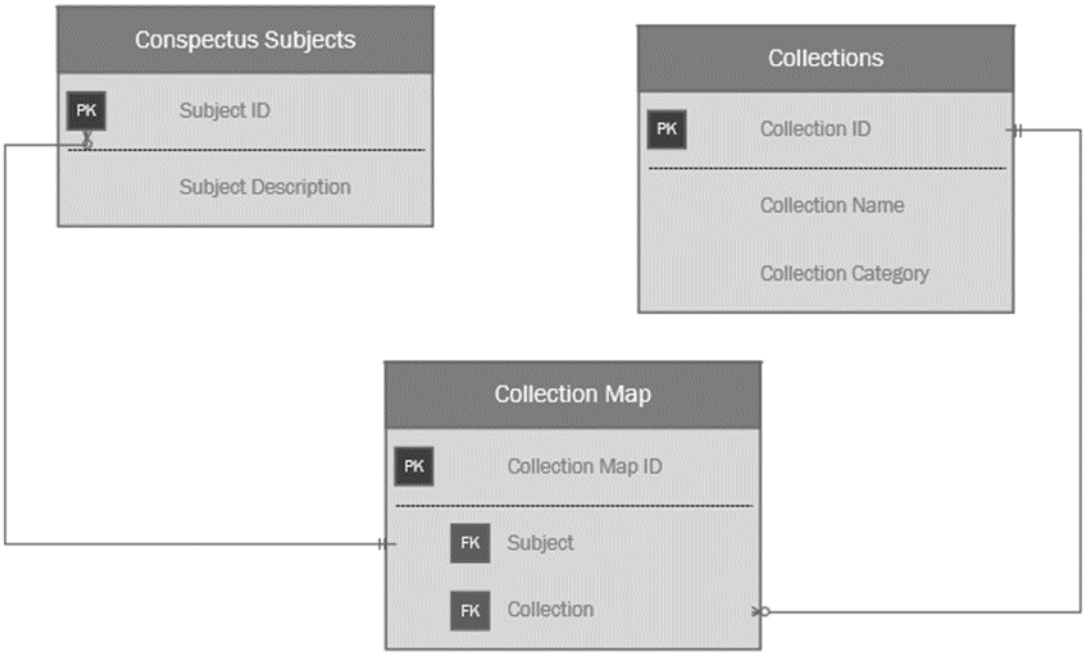
Fig. 1. Independent silos of collections data

We could connect these data for selected reports, but this required extensive work each time such a report was needed. Furthermore, we were interested in evaluating our subject-specific collections in addition to our collections as a whole. This requires an efficient method of assigning the subsets of data to the subject-based collections. For example, reporting on the holdings of books only on American history, or usage of e-resources specific to biological sciences. Towards that end, we are currently working to organize our data silos into a cohesive Collections Data Repository of interconnected data stores organized around the Collection Map.

3.2. *Collection Map*

Our current data model centers on our Collection Map, which is based largely on the Conspectus subject taxonomy described earlier. These subjects were defined as comprehensive, non-overlapping ranges of Library of Congress classification numbers. Examples of the ranges include: Ecology (QH540-549); Management. Industrial Management (HB28-70); and Anthropology, General

(GN0-298) (Bushing, 2006). Some libraries have effectively "mapped" call number ranges to subject areas for the purposes of describing their collection (Hiebert, 2009; Hyödynmaa et al., 2010; Lumande & Ojedokun, 2005). These mappings, however, are usually very broad and mutually-exclusive. For example, all of QH is mapped to "Biology" only, and all of HB is mapped to "Business" only. This does not allow for describing very specific subjects, like "Ecology", or interdisciplinary subjects, like "Environmental Sciences". Furthermore, it limits the scope of subject-based collections to only the most core subjects. We used a relational database model to allow our collections to include the specific subjects, and only those subjects, relevant to the degree programs (see Figure 2).



Fig, 2. Collection Map database diagram

3.3. *The Collection Map Database*

3.3.1. *Database Structure*

The Collection Map is a relational database linking a set of subject-based collections with Conspectus subjects, which are defined ranges of Library of Congress classification (LCC) numbers. Because it is relational, any one Conspectus subject may be assigned to one, more than one, or no collection. The relationships are neither comprehensive (some Conspectus subjects are not assigned to any collection), nor mutually-exclusive (some Conspectus subjects may be assigned to multiple collections). The core of this database is represented by Figure 2.

3.3.2. *Data Processing*

The simplest form of this system is a Transact-SQL program that assigns the most appropriate Conspectus subject to an item based on the LC call number. Once all items are assigned this Conspectus subject, then queries may be generated to produce lists or summaries of holdings based on the association of the Conspectus subject to the subject-based collections.

More complex solutions include linking the Collection Map tables in other SQL Server databases. This enables the direct association of the data with the collections. In addition, other classification systems besides the LCC may be similarly mapped to collections. For example, the Journal Citation Reports (JCR) provides bibliometric indicators for journals. We can compare our holdings against these listings as a qualitative method of collection evaluation. The JCR categorizes journals using their own subject lists. We assigned to the subject-based collections, which enables us to produce similar queries and reports.

3.3.3. *Connections to Outputs*

These queries may be used to produce manually-created reports, such as for the accreditation reviews or comprehensive collection evaluations for making collection development decisions. Furthermore, other systems, like Tableau Public, may connect to these queries and use the data for automatically generating charts, tables, or other visualizations.

4. Applications

With the Collection Map forming the center of our Collections Data Repository, data related to any item with a Library of Congress Classification (LCC) number can be summarized by subject-based collections. Of course, not all items in our collection have such identifiers. For example, a common method of assessment is checking holdings against an authoritative list of titles, like the Journal Citation Reports. Ideally, we would provide access to the highest rated journals. The JCR, however, does not include LCC numbers with the lists of journal titles. It does however, categorize the journals by subject, and these subjects may themselves be mapped to one or more (or none) collections.

The Collection Map, therefore, serves as the hub of the Collections Data Repository (see Figure 2). We are able to collect data on user Needs, Access to information, Quality of information provided, and Usage of the resources at the subject-based collection level (see Figure 3). Currently, our repository is rather crudely organized, with several data sets regularly updated in a robust, Microsoft SQL Server environment, and others being collected as needed using whatever tools are available. Plans are underway to fully integrate all the necessary data sources into a complete and secure data warehouse that can be tapped to generate routine and ad hoc reports. The primary reporting mechanism will be visual interface, through which data may be combined, summarized and displayed using the most appropriate charts and graphs. Currently, we have been using Tableau Public to generate “dashboards” and “stories” to compare aspects of the subject-based collections, including holdings (Access), interlibrary loan requests (both a representation of Access and Need), and circulations of materials (Usage), against enrollment (Need).

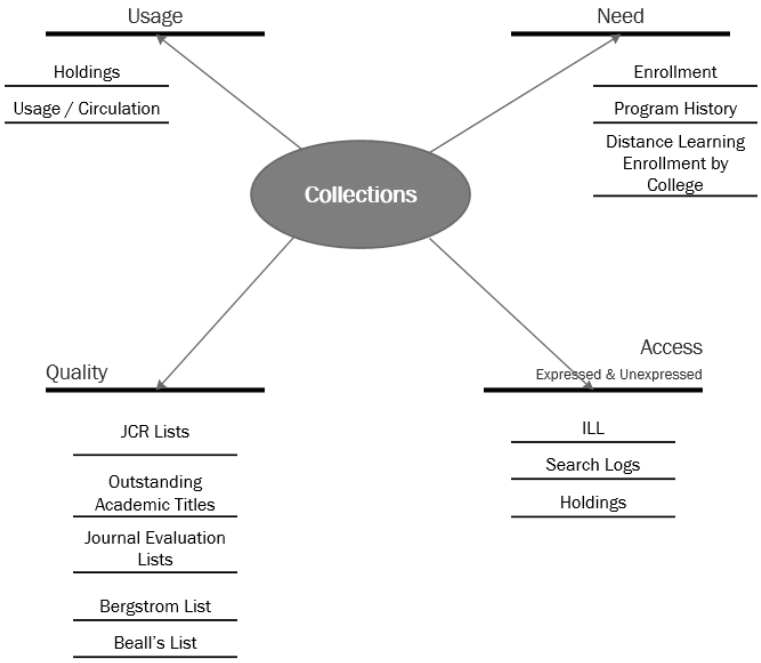


Fig. 3. Conceptual Model of the Collections Data Repository

5. Future Plans

Plans for the future include more automated connections with both internal and external data sources. The UNT Data, Analytics and Institutional Research department, for example, is generating a university-wide data warehouse. This would include up-to-date enrollment and learning outcomes data. Internal data sources to be automated would include search logs of the local search systems (the UNT Libraries' Web site, the library catalog, and the Discovery service), summary data values of holdings and circulation, and usage of electronic resources (online books, databases, and journals). A more complete database diagram appears as Figure 4.

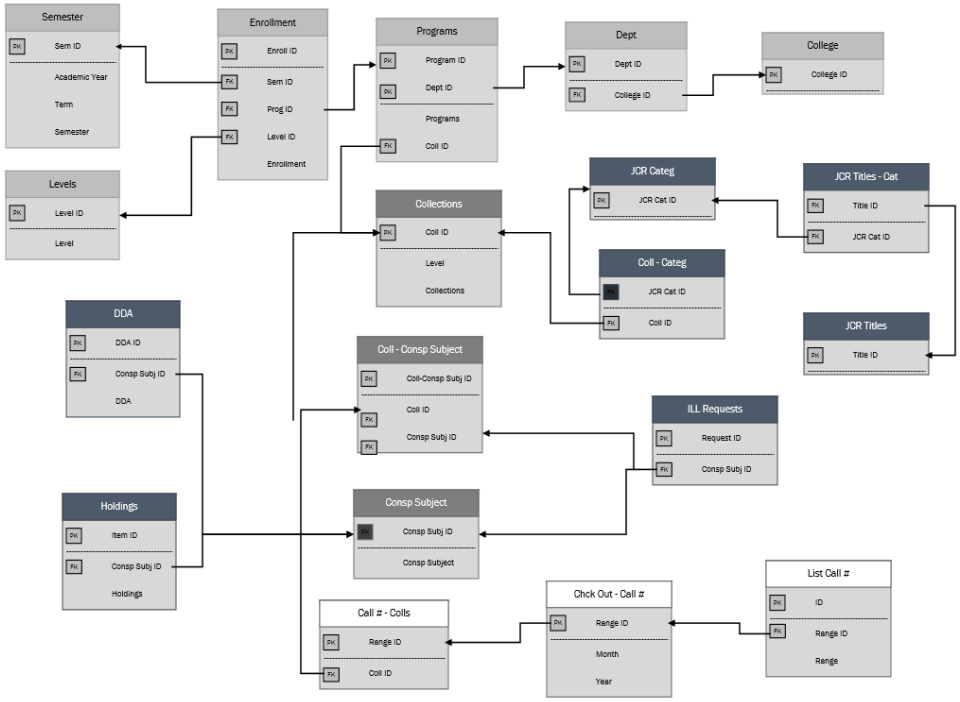


Fig. 4. Database diagram of Collections Data Repository

References

ACRL. (1959). Standards for college libraries. College & Research Libraries News, 20(4), 273-280.

ACRL. (1979). Standards for university libraries. College & Research Libraries News, 40(4), 101-110.

Beals, J. B., & Gilmour, R. (2007). Assessing collections using Brief Tests and WorldCat Collection Analysis. Collection Building, 26(4), 104-107. doi:10.1108/01604950710831898

Beiser, K. (1987). Essential guide to dBASE III+ in libraries. Westport, Conn.: Meckler.

Blake, J. C., & Schleper, S. P. (2004). From data to decisions: Using surveys and statistics to make collection management decisions. Library Collections, Acquisitions and Technical Services, 28(4), 460-464. doi:10.1016/j.lcats.2004.09.002

Breeding, M. (2007, March 1,). An update on Open Source ILS. Computers in Libraries, 27, 27.

Brown, J. M., & Stowers, E. D. (2013). Use of data in collections work: An exploratory survey. Collection Management, 38(2), 143-162. doi:10.1080/01462679.2013.763742

Bushing, M. C. (2006). Collection mapping - An evolving tool for better resources and better access. Signum, 39(3), 9-19.

Butler, E. S. (1997). Using Microsoft Access: A how-to-do-it manual for librarians. New York: Neal-Schuman.

Drury, F. K. W. (1930). Book selection. Chicago: American Library Association.

Electronic tape-activated typewriter used for automatic catalog card processing. (1960). Law Library Journal, 53, 508.

Fosdick, H. (1980, July). Microcomputer revolution. Library Journal, 105, 1467-1472.

Gardner, M., & Pinfield, S. (2001). Database-backed library websites: a case study of the use of PHP and MySQL at the University of Nottingham. Program, 35(1), 33-42. doi:10.1108/EUM0000000006941

Gaston, P. L. (2014). Higher education accreditation: How it's changing, why it must (First ed.). Sterling, Virginia: Stylus Publishing, LLC.

Greene, A. (2008). Managing subject guides with SQL Server and ASP.Net. Library Hi Tech, 26(2), 213-231. doi:10.1108/07378830810880324

Haines, H. E. (1935). Living with books: The art of book selection. New York: Columbia University Press.

Harker, K. R., & Klein, J. B. (2016). Collection assessment. Washington, DC: Association of Research Libraries.

Hensinger, J. S. (1988, Sep 1,). Laptop computers: You can take them with you. Online, 12, 57.

Hiebert, J. T. (2009). Beyond mark and park: Classification mapping as a collection development tool for psychiatry/psychology. Collection Management, 34(3), 182-193. doi:10.1080/01462670902974996

Hyödynmaa, M., Ahlholm-Kannisto, A., & Nurminen, H. (2010). How to evaluate library collections: a case study of collection mapping. Collection Building, 29(2), 43-49. doi:10.1108/01604951011040125

Johnson, P. (1999). Evolution of a specialization: from selection to collection: Development and management. Technicalities, 19(8), 1-10.

Johnson, P. (2004). Fundamentals of collection development & management. Chicago: American Library Association.

Johnson, P. (2009). Collection analysis: Evaluation and assessment. Fundamentals of collection development and management (2nd edition ed., pp. 225-263). Chicago: American Library Association.

Loertscher, D. V. (1985). Collection mapping: an evaluation strategy for collection development. Drexel Library Quarterly, 21(2)

Lumande, E., & Ojedokun, A. A. (2005). Collection mapping as an evaluation technique for determining curriculum and collection relationship: the University of Botswana Experience. African Journal of Library, Archives and Information Science, 15(1), 25-33.

New specialized typewriter. (1937). Library Journal (1876)., 62, 842.

Nisonger, T. E. (2003). Evaluation of library collections, access and electronic resources: A literature guide and annotated bibliography. Westport, CT: Libraries Unlimited.

Nisonger, T. E. (2005). Evaluation of library collections, access and electronic resources: A literature guide and annotated bibliography. Library Collections, Acquisitions, & Technical Services, 29(3), 340-341. doi://dx.doi.org/10.1016/j.lcats.2005.10.007

Nitecki, D. A., Wiggins, J., & Turner, N. B. (2015). Assessment is not enough for libraries to be valued. Performance Measurement Metric, 16(3), 197-210. doi:10.1108/PMM-10-2015-0032

Oakleaf, M. (2010). Value of Academic Libraries: A Comprehensive Research Review and Report. Chicago: Association of College and Research Libraries (ACRL).

Parker, R. H. (1936). Punched card method in circulation work. Library Journal (1876), 61, 903-905.

Parrish, D. A., Schyndel, M., & Erdman, J. M. (2009). Using a Database as an Assessment Reporting Tool. Technical Services Quarterly, 26(3), 207-216. doi:10.1080/07317130802520229

Schad, J. G., Borkowski, D., MacLeod, M. J., Massman, V. F., Voigt, M. J., Trueswell, R. W., & Kent, A. (1979). Pittsburgh University studies of collection usage: A symposium. Journal of Academic Librarianship, 5(2)

Schmidt, J. B. (1989). Collection evaluation and the conspectus: chimeras in library cooperation? Australian Academic & Research Libraries, 20, 29-37.

Simon, J. C. (2015). Building your own ERMS. Library Hi Tech News, 32(3), 9-12. doi:10.1108/LHTN-08-2014-0071

Steve Hiller, & James Self. (2004). From Measurement to Management: Using Data Wisely for Planning and Decision-Making. Library Trends, 53(1), 129.

Thompson, L. S. (1951). History of the measurement of library service. The Library Quarterly, 21(2), 94-106. doi:10.1086/617755

Trueswell, R. L. (1969). Some behavioral patterns of library users: The 80/20 rule. Wilson Library Bulletin, 43(5), 458.

Twiss, T. M. (2001). A validation of Brief Tests of Collection Strength. Collection Management, 25(3), 23-37.

White, H. D. (2008). Better than Brief Tests: Coverage power tests of collection strength. College & Research Libraries, 69(2), 155-174. doi:10.5860/crl.69.2.155

Williams, J. G. (2003, Mar 1,). Taming the wireless frontier: PDAs, tablets, and laptops at home on the range. Computers in Libraries, 23, 10.

Wood, R. J., & Strauch, J. (1996). Collection Assessment. A look at the RLG Conspectus Haworth Press.

WorldCat. Retrieved from http://www.worldcat.org/