A BIBLIOMETRIC ANALYSIS OF UNDERGRADUATE THESES FROM THE SCHOOL OF LIBRARY AND INFORMATION STUDIES FROM 2010-2014: AN EXPLORATORY STUDY

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Abstract

This study focused on the use of bibliometrics to perform qualitative research on the citations used in the undergraduate theses of UP SLIS from 2010-2014. The first step was to create a citation index that contains the article titles, authors, and journal titles used by the undergraduate students. Using existing tools such as BibExcel and VOSViewer, the researchers were able to convert the citation index from .xlsx file to .net file, producing bibliometric maps that reflect the relationships of the authors to each other and to the research tracks of UP SLIS. The citation index created by the researchers allowed them to also perform quantitative analysis on the journal titles used by the undergraduate students based on their research tracks. The researchers were able to identify the titles of the journals used by the students, and study their citation trends across the different tracks of UP SLIS. Bibliometrics is a field of study that has not been fully explored in UP SLIS. Through this study, the researchers were able to show how it can be used to reveal the research output of the college and its implications. The researchers also hope that with this study, other students would consider bibliometrics as their research topic for their theses.

Keywords: *bibliometrics, University of the Philippines School of Library and Information Studies, citation index*

Introduction

All of scholarly literature is connected inextricably, and this connection is no more evident than in the form of citations. The papers which authors reference when producing scholarly work imbeds their current work into a web of prior knowledge, ensuring that the place a paper occupies in a particular field is well-defined and accessible to other interested researchers. In a way, they are

"intellectual transactions, formal acknowledgments of "intellectual debt" to earlier authors (Garfield, 1997).

With the surge in availability of academic papers, the prospect of navigating the academe becomes increasingly difficult, and there arises a need for tools with which to select works which are of great relevance to researchers' interests. Managing electronic information, given this volume of work, has become extremely time-consuming (Alvarado, Teevan, Ackerman, & Karger, 2003).

The increase in accessible information also makes the analysis of metadata viable, which in turn help consolidate the huge body of knowledge being generated from day to day. Bibliographic citations are expedient in tracing pathways through research documents, the relationships within them and how they connect to form parts of a whole, through increasingly complicated analytic toolkits (De Bellis, 2009).

Thusly, the study has sought to apply the principles and methodologies of bibliometrics to the body of citations used in the undergraduate theses of the University of the Philippines School of Library and Information Studies (UP SLIS) from 2010-2014. Among the questions which the study aimed to answer were the following:
1. How are the underlying conceptual relationships between the authors of papers cited by students of the UP SLIS in their undergraduate theses represented or brought to light by bibliometrics analysis?
2. How are the fields of study from which the undergraduate theses of students of the UP SLIS related to each other within the context of the tracks as defined in the SLIS curriculum?
3. How do these relationships define the research output of the UP SLIS?

In addition, this exploratory study was also conceived of as a vanguard for other studies of a similar nature to be applied to the Philippine librarianship setting.

The bibliometric study was done on 151 undergraduate theses from AY 2009-2010 until AY 2013-2014. A total of 4,408 citations were recorded and encoded in the citation index.

Review of Related Literature
Bibliometrics has many applications, and it has been used extensively to study the research behavior and cognitive linking between authors, both in the hard sciences and the social sciences.

John Budd and Corrie Christensen published a paper looking at the extent researchers in the social sciences are using electronic information resources. They performed a citation analysis on eight social science journals namely *Quarterly Journal of Speech, Review of Educational Research,*

American Political Science Review, American Economic Review, American Sociological Review, American Anthropologist, Academy of Management Journal, and *American Psychologist* which concluded that the majority of cited sources are journal articles and books, and that the content of a material is more important than the medium.

In another article, this time published by Jeffrey Kushkowski in 2005, the Web citation behavior of print and electronic theses of graduate students in Iowa State and Virginia Tech from 1997 to 2003 was studied. This study confirmed that "Web citations are relatively rare in academic theses" even though there is an increasing trend of their usage every year (Kushkowski, 2005). Said paper's results and analysis provide justification for this paper's foray into a similar study on a particular dataset. It would be interesting to see how the breakdown for undergraduate theses in UP SLIS would compare to other sets of data, and to think about what this might imply with respect to the exploration of the behavioral and social aspects of citation.

In 2011, Joanne Smyth used citation analysis to determine research practices of students in history, psychology and education when electronic journals and online sources were introduced. In this study, it was observed that differences among the number of sources used and the ratios of monograph to journal citations. Among the three disciplines, history students use monographs and journal articles that are double in number than the citation ages of the materials used by students of psychology and education. The results of her study not only show the different citation behaviors of the students, but it also helps inform the library of the information needs of the students. With it, they can make better decisions in managing their collection and making sure that students can access the information they need.

Bibliometrics can also be used to study research output of an institution or a country. An example of this is a study conducted by Degelsegger and Gruber (2012) entitled *Bibliometric studies on ASEAN research output and ASEAN-EU cooperation*. Not only were their study able to study research output by topic, they were also able to show research output by country. They also used bibliometrics to study international co-publication wherein the authors working in a single publication came from different countries. In opposition, this study focused on a very insular group, wherein individuals responsible for accumulating the citations come from a single institution.

Bibliometrics, through the application of citation analysis, can help determine a set of core journals that is usually cited from by an institution. This could help libraries determine which journals to subscribe to for their users (Gureyev & Mazov, 2013), and support certain collection development polices, or inform the acquisition of resources of an institution.

Bibliometric methods can also be applied in studying the interdisciplinary characteristics of research output of an institution. According to van Raan (2000), there are three bibliometric methods for studying interdisciplinarity: creating the institution's research profile, creating the research

influence profile, and creating bibliometric maps. These three methods were present in van Raan and van Leeuwen's (2002) study on the research output of the Nutrition and Food Research. Aside from these methods, impact measures can also be used in measuring interdisciplinary characteristics (Rinia, van Leeuwen & van Raan, 2002).

These studies provide a foundation of previous research which shows the breadth of topics upon which a bibliometrics approach to citation data can be counted on to enlighten certain aspects of a field. This flexibility has led to the conception of this paper as an exploratory study.

Bibliographic Coupling and Co-citation
Figure 1 illustrates a fundamental element of bibliometrics—co-occurrence via bibliographic coupling and co-citation. These connections form the backbone of a bibliographic network map, and the network and clustering algorithms upon which the visualizations are generated rely upon these as basic units.
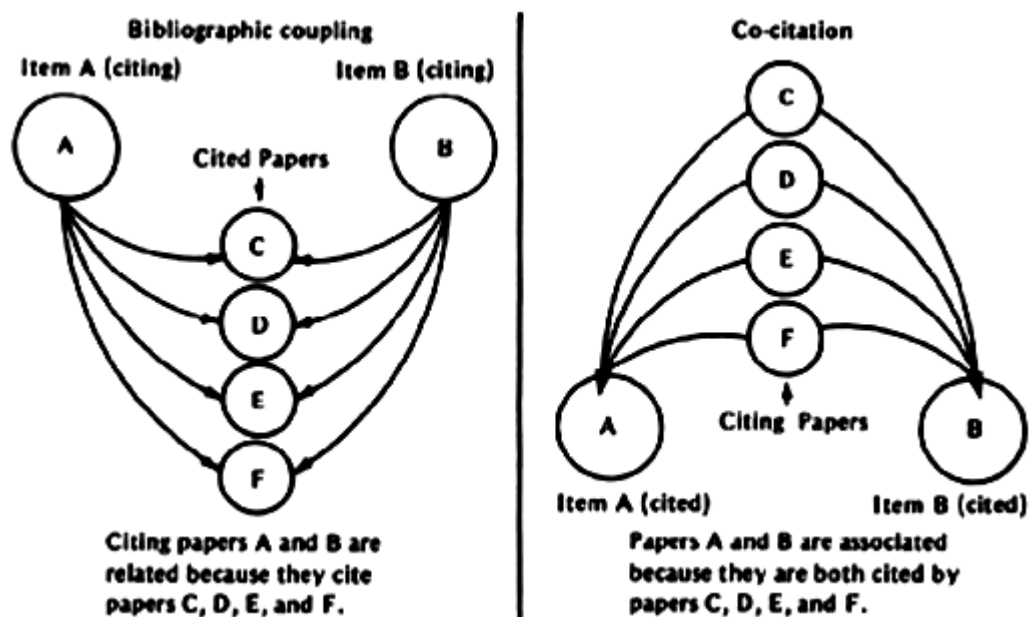

Figure 1. Bibliographic coupling vs. co-citation. (Garfield, 1997)

Bibliometric studies have been applied in the theses and dissertations of students in the University of the Philippines Diliman. In a thesis done by Jeffrey Meraña, he performed a citation analysis on the graduate theses from the College of Science, College of Arts and Letters (CAL), and from the College of Social Sciences and Philosophy (CSSP). According to his study, foreign materials

dominate citations of CS theses, local materials for CAL, while none for CSSP. This study's results may help in the collection development and management of the University Main Library as well the respective college libraries. It also revealed the need to have a standard manual for thesis writing to avoid incomplete bibliographic citations.

Application of bibliometrics to Philippine librarianship literature was done by Lourdes Tenmatay David in 1985. Citation analysis was done on 192 master's theses and special problems submitted to 28 colleges and universities in the Philippines. Her focus was to identify the growth and characteristics of literature on Philippine librarianship by considering only Filipiniana library science materials. This was done by determining (a) the distribution of the bibliographic forms cited, (b) the time distribution of the cited articles and source materials, (c) highly cited materials, authors, editors, compilers and periodicals and (e) if the number of citation decline over the years. Her analysis included using statistical methods such as rank analysis, percentage occurrence, and Bradford's distribution. Her study concluded that the literature of Philippine libraries and librarianship have grown since the introduction of library science in the country.

The emergence of the Internet provided additional source of information for researchers. In 2005, Doven Peñaranda published his thesis on the impact of the internet on the students of the University of the Philippines Institute of Library and Information Science (UP ILIS). He performed citation analysis on the theses and special problems submitted from 1998-2003 and studied (a) trends in citing electronic sources, (b) how frequently electronic sources were cited, (c) the distribution bibliographic forms of source materials used in the undergraduate theses, graduate theses, and special problems, and (c) the accuracy and persistence of the cited internet documents or Uniform Resource Locators (URLs). The Jonchkee-Terpstra (JT) test was performed to test for trends in the citations. Chi-square test showed the difference in proportions of e-sources among the theses and special problems. Correlation analysis was performed to determine the behavior of citation on certain kinds of sources. Based on the results of his study, the Internet has had a significant impact on UP ILIS students. The increasing use of e-sources from 1998 to 2003 proves that the Internet is becoming a significant information source in the field of librarianship.

It is clear from the literature reviewed above that traditional methodologies have monopolized citation analysis locally. This is the case even as bibliographic network studies have risen in prominence over the years in the field of library and information science, and there is healthy interest in it abroad. This means that researchers are potentially missing out on a whole facet of citation analysis by not employing bibliographic mapping. This study aims to break open the floodgates, so to speak, and encourage the adoption of this paper's methods in analyzing citation data in this institution.

Methodology
Titles of the theses included in the research were taken from the lists available in the Dean's

office as well as the theses catalogs available at the SLIS library.

Three software applications were used: Microsoft Excel, BibExcel, and VOSViewer. Microsoft Excel was chosen as it is a ubiquitous program and is standard on many machines. Microsoft Excel will be used to record the data from the theses and their citations. The application was chosen for its ability to export its spreadsheets into .txt files which will be entered into VOSViewer. The mentioned tools, with the exception of Microsoft Excel, are open source and free to use.

Over 4000 citations from 150 undergraduate theses from the UP SLIS over the past five years were entered into a citation index. This body of data was then subjected to both standard citation analysis and bibliometrics mapping. Both frequency data and bibliographic clustering data were obtained from the dataset.

A citation index was created using Microsoft Excel. The spreadsheet was then converted to a text file, which was given ISI headers in order to fit the specifications required by the software used, namely BibExcel. This conversion allowed the bibliometrics tool BibExcel to process the data and build relationships between them.

BibExcel itself works with a dialog file, which has the file name extension .DOC. From this .DOC file, fields delimited by the tags may be extracted and used in making an OUT file, which can then be manipulated into showing data such as frequency or co-occurrence of authors or other data points. This is the file format in which the bibliographic calculations are performed (Alfonzo, Sakraida, & Hastings-Tolsma, 2014).

From said OUT file, a CIT file, which would show the frequencies of the chosen tag to be analyzed, were created using tools native to BibExcel. From here, the relevant points of data must be selected from the list in order to determine on which data points co-occurrence would be measured for. This coupled with the earlier .OUT file, will then be used to create a .COC file, which shows the relationships in a matrix. In order to be visualized in VOSViewer, it has to be processed into a .NET file. This .NET file is then fed into VOSviewer by choosing to create a new map, then choosing to create from a Pajek file, and then choosing the previously created .NET file form BibExcel.

An additional field was created in order to differentiate the theses into the different research tracks they belong to within the categorization of undergraduate work in the SLIS. The assignment of tracks is based on the suggested topics under each research track as listed on the UP SLIS Website. Due to the nature of the software used and the file format the data on the spreadsheet is to be converted to, the additional field needed a bit of customization in order to show up alongside the other categories in an ISI format file.

Presentation, Analysis and Interpretation of Data

The bibliographic mapping of authors in the 4408 citations gathered show that the most frequently cited author is Joan Reitz, predominantly for her work *The Online Dictionary of Library and Information Science.* For the co-citation analysis, 369 authors met the criteria of having at least two co-citations and were included in the analysis.

Figure 2. Bibliographic network map of authors with clustering.

Figure 2 is an overview of the bibliographic network map generated from the data using author co-occurrence. The distance of the data points in relation to each other is influenced by the number of connections they have with each other, while the area of the sphere correlates with how many citations were garnered by each author relative to others. VOSviewer itself automatically applies a clustering algorithm to delineate relationships between data points further. At a cursory glance, it can be surmised that the visualization has formed a star shape- with a dense, central core of highly cited works and spokes which show research into more insular topics.

The observation that Reitz was the most prominent name should not come as a surprise since her work on the *Online Dictionary of Library and Information Science* is seminal to many students who look for definitions of terms within the field of LIS. Indeed, it could be reasoned that since the theses submitted necessarily include a section on definition of terms, practically almost all theses should have cited this work.
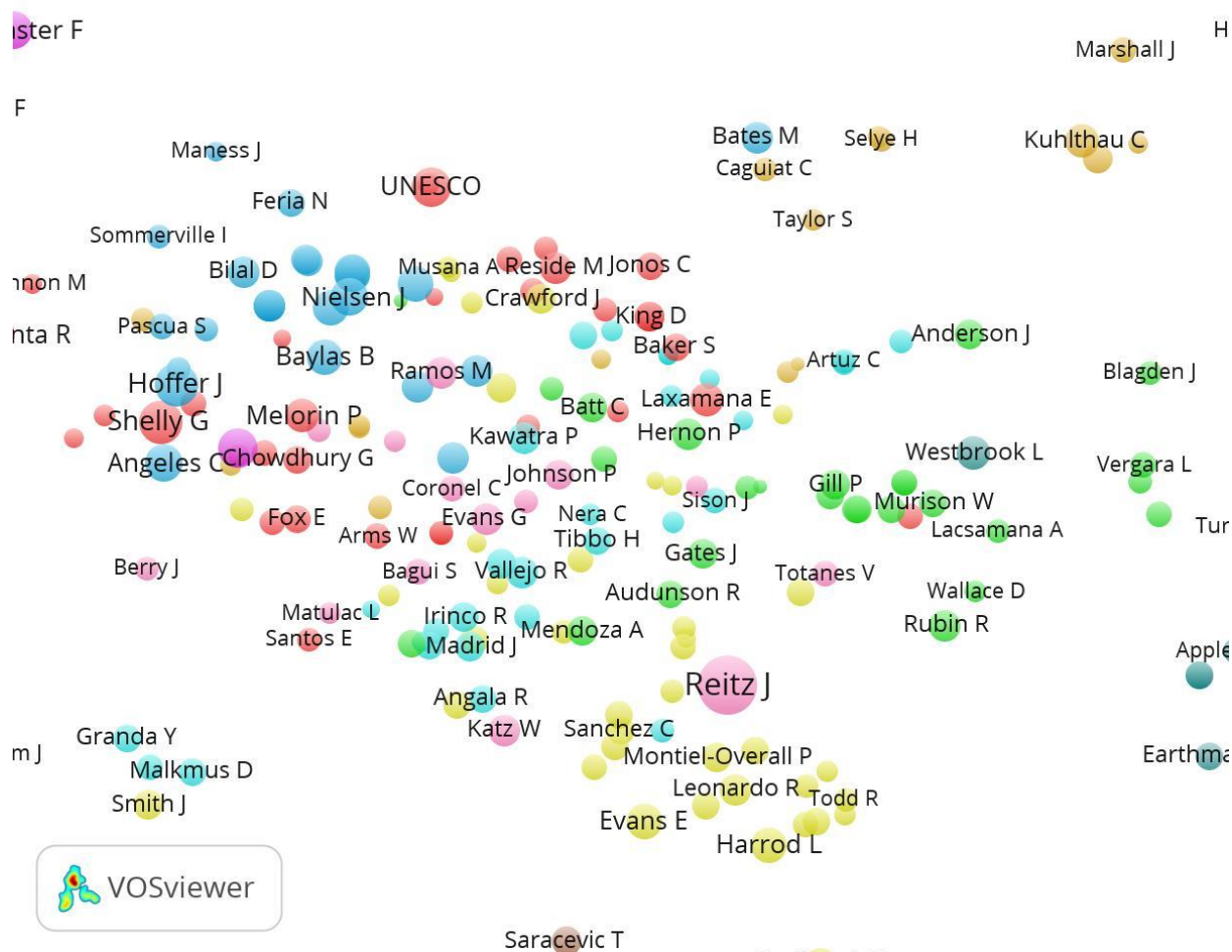
Figure 3. A closer look at the central clusters.

Looking at Figure 3, the central area is the most complicated and varied- a lot of the clusters in this area have significant overlap and in fact are spread all over the place. Even though this is the case, the field of information technology, identified by the blue color of its data points, looks to be well packed and not spread out like the others. Hoffer leads the pack with the most number of citations, which is to be expected since his work is a go-to resource for systems analysis and design.
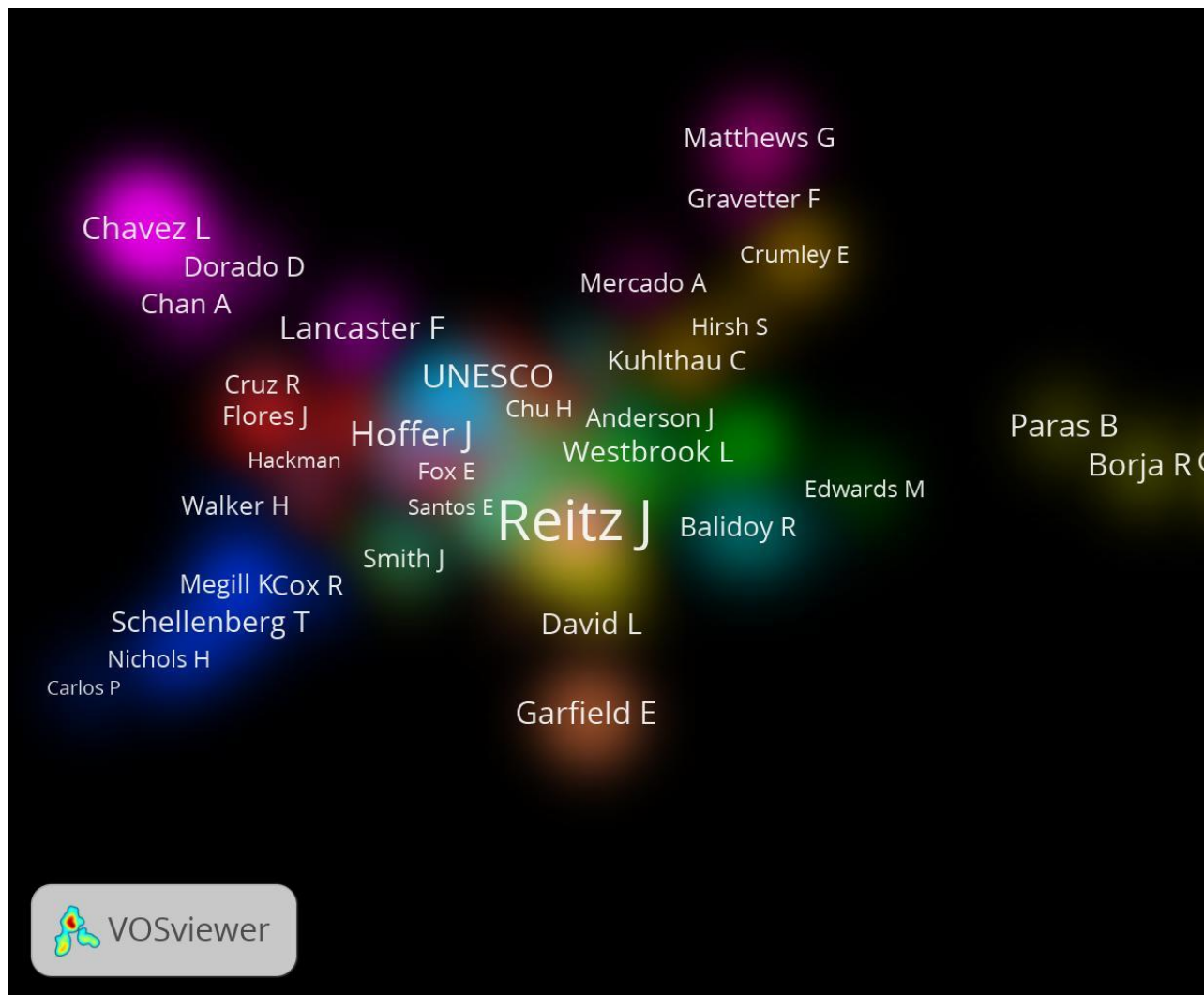
Figure 4. Cluster density view.

The cluster density view in Figure 4 highlights the most prominent authors within every cluster. The notable authors of each cluster were identified along with their area of expertise or most prominent work identified and tabulated below.

Table 1

Most Notable Author per Cluster (N = 369 authors)

| Cluster	Author	Description of Work
1	UNESCO	Multi-disciplinary, works fell under many disciplines such librarianship, information systems, preserving culture and cultural heritage.
	Shelly G	Works fell under information and computer systems (including system analysis and design)
2	Hernon P	Librarianship
3	Schellenberg T	Archives, archives management
4	Harrod L	General reference materials for librarians
5	Young H	Glossary for librarians
	Lancaster F	Information systems, library evaluation, general reference materials
6	Kawatra P	Librarianship, dictionary for librarians
7	Hoffer J	Systems analysis, database management
8	Kuhlthau C	Libraries
9	Belo B	Electronic sources
10	Reitz J	ODLIS
11	Garfield E	Citations, indexing
12	Westbrook L	User needs
13	Matthews J	Evaluation of libraries, disaster management in libraries
	Mercado A	UP SLIS unpublished work
14	Haftner A	Library

Clustering Analysis

The brown cluster located at the bottom of the bibliographic map is interesting because of its very insular properties. Unlike the other radiant clusters which tend to have a line of cited authors progressively streaming back into the core, this one has a tightly knit knot which consist of authors who are almost always cited with each other. It seems that at least for this dataset, to cite Garfield is to cite Hjorland is to cite Bradford. This is not surprising: these authors form a core of bibliometrics and are also tightly connected in the larger community of researchers in this field. Bradford, as an exemplar, is the moniker for *Bradford's Law,* one of the most used metrics by which to measure scholarly impact in theses under citation analysis in SLIS.

The richest in terms of citation density seems to be the field of archives and records management, the dark blue cluster in the lower left area of the bibliographic map. It could be said that this field, is the most developed track in terms of the variety of popularly cited works. In contrast to the brown cluster wherein there are a few core people upon which the whole topic revolves, there is a healthy spread of authors in the dark blue cluster which points to the students having a variety of works to use as references and options to pick from when deciding upon which works would fit their own line of inquiry the best.

The cluster to which Reitz belongs to, as emphasized by the pale pink color, seems to be composed of works which are also cited across the board. Most of these are under collection development. To the bottom, the authors in yellow are active in the field of reference and information services. Given some thought, it is indeed plausible that the topics of collection development and reference service have a lot of overlap, as they too share the distinction of being viewed as core LIS subjects.

The same can be said for the green and teal clusters which are seen intertwined in Figure 5. Though not as thoroughly ensconced in the dense center as the others, they do share a lot of overlap which is distinguishable from the dense core. These two clusters seem to follow the topics of management and public libraries, and user evaluation.
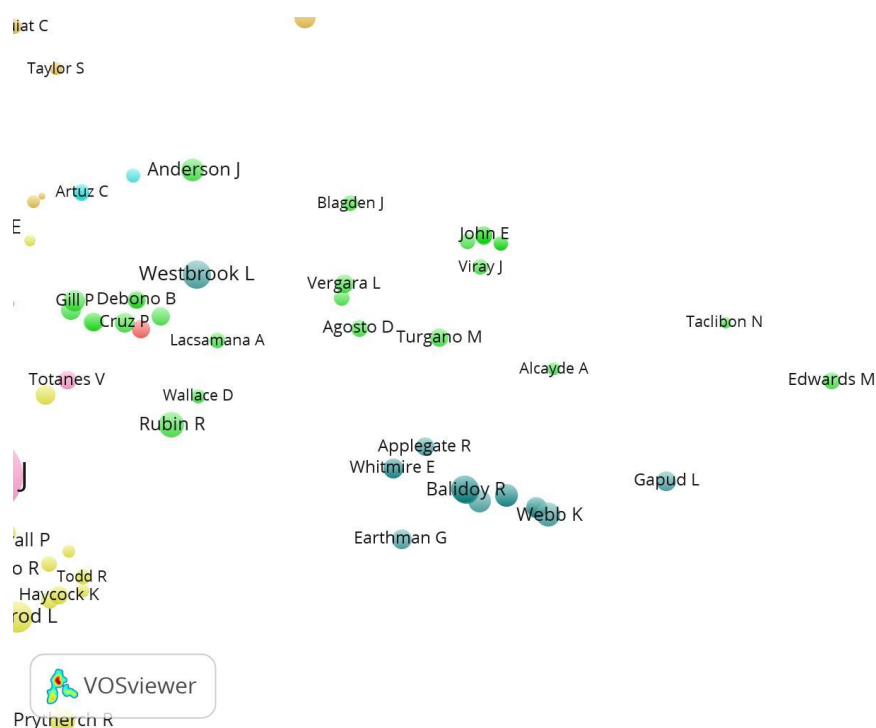
Balaquit, J. P. S. & Bugnosen, M. G. (2015). *A Bibliometric Analysis of Undergraduate Theses from the School of Library and Information Studies from 2010-2014: an Exploratory Study. Journal of Philippine Librarianship, 35, pp. 35-52.*

Figure 5. Mixed cluster to the left of central cores.

All in all, it can be said that there are marked differences in the citation behavior of students according to the research topic they have selected for them to pursue. Certain thesis topics are very insular in nature: they are tightly bound and have almost no connection to the core except for references cited to get definitions of LIS concepts. In fact, theses of this trend have strikingly similar titles, often changing only the institution/s on which said specialized topic is performed. A deviation from this is the field of archives and records management. Although this cluster deviated well from the core, it has a healthy smattering of references and research types. Another, perhaps less pronounced deviation, is the field of information systems. There is a respectably dense IT core which has major overlaps with the central authors, and the pull of many subtopics which use concepts from information systems in more specialized topics such as thesaurus construction or medical librarianship. It is interesting to note that law librarianship, on the other hand, lurks somewhere in the central mess of data points. Perhaps this is due to the reliance of medical librarianship upon online journal subscriptions, which imply a greater dependency upon electronic information systems.

The bulk of the theses do not stray so far from the core in terms of citations. Topics such as collection development, reference service, evaluation of library services and management in general do not deviate so much from the core LIS topics.

Again, information technology and information system topics are close to the core references, and the researchers speculate that this is due to the nature of these topics as toolsets to be applied to different areas of LIS.

Analysis of Authors

After determining the most notable authors per cluster generated by VOSViewer, the next step was to compare these authors to the authors cited in foreign research studies. Using Google Scholar, an online database of resource materials for scholarly research, and terms associated with the different research tracks of SLIS and the titles of the undergraduate theses in the citation index, the authors with the most cited works on Google Scholar were compared with the most notable authors per cluster. Only Garfield E, Shelly G, Schellenberg T, and Westbrook L were similar. Evans GE as well as Wilson TD and Katz W from the citation index were among the most cited authors produced by Google Scholar.

It can be assumed that since these authors are some of the most cited on Google Scholar, the information gathered by the students from these authors are well established in their respective fields and sub-fields. However, factors such as keywords used, database and or search engine used by the student may produce different results from that of Google Scholar. The researchers also have to take into account the preference of the student when choosing his/her citation. Perhaps it was based from the title of the work, author, or keywords used, or perhaps the number of citations it has. It was also noted

that from the citation index, no undergraduate student consulted Google Scholar. It was assumed therefore that either the student is more concerned with the title and or subject of a certain work he/she wants to cite rather than the number of citations a work has, or he/she is not familiar with Google Scholar.

It is interesting to note that the only local notable author showed to be cited by VOSViewer, Mercado A, was cited for his M.L.S. special problem, *The Effectiveness of HERDIN (Health Research and Development Information Network) as an Information System as Perceived by its User*.

Analysis of Journals Used

After tabulating the number of journals used in each research track per year, the researchers observed that there is no visible trend that can be observed in the journal use of each research track between 2010 and 2014. Before creating the table, the researchers expected that there will be an increasing trend for journal use because of the ability to access online journals is available to students, whether free or through the university's online subscriptions. However, this did not seem to be that case.

From the data gathered, researchers assumed that journal use is relative to the specific research problem of the student. Another factor to consider is that there were a lot of students who did not properly cite their journal citations, citing them as an Electronic Source instead of Articles and Book Chapters as instructed (ILIS Faculty, 2012).

Another reason why the researchers determined the number of journals used by the students was to explore if the research output between 2010-2014 exhibit interdisciplinary characteristics. Based on the top 20 journal titles cited in each research track per year, the students cite mostly journals in the librarianship discipline. However, there are journals such as *Family Medicine*, *Psychological Bulletin*, and *Journal of Occupational Health Psychology* that were also cited by many students. Journals outside the library discipline that were not included in the tables had been cited at least once.

Students cite librarianship journals because the theories and methodologies presented in these have been proven useful in the librarianship profession. One interesting line of query is that if the data collected can bolster this reasoning.

The researchers made an assumption that the students also use theories and methodologies from disciplines outside of librarianship. It would highly depend on the nature of the research problem of the student. For example, if a student's research problem is under the Health and Medical Librarianship track, it is possible that he/she would consult medical journals to gain insights in the theories and methodologies of the field of medicine, and incorporate it into the theories and methodologies she had learned from the librarianship profession. The same can be done in all of the research tracks of SLIS.

Therefore, it can be said that the research outputs of the students show interdisciplinary characteristics. By taking theories and methodologies from other disciplines, librarianship students are able to integrate them in their research studies, producing outputs that are more integrated and specialized in nature.

Principal Findings of the Study

Bibliometric tools as were demonstrated in this study are an excellent complement to qualitative research that deal with citation analysis, especially when supported by frequency data and other quantitative measurements. Care must be taken to view the visualizations in the proper context and with careful deliberation on appropriate handling of the data. Trust must not be blindly given to the clustering algorithm, as this kind of mapping is highly sensitive to the specific atmosphere of the dataset it is applied to. A work might be cited by a thesis only to be refuted- there must always be an understanding of the "place" a certain work has within the works it has been cited in.

The constant mislabeling of journal articles which happened to be retrieved online as electronic sources might be a symptom of students reaching for so called "low hanging fruit" – that is, instead of carefully curating the sources which they use, they opt for references which are easier to obtain.

The clustering analysis revealed that there is a rhyme and reason to the citation behavior of undergraduates writing their theses. Archivists are cited along with other archivists, theses with similar titles are cited with each other, more often than not cited by a thesis with a similar title to them both, but with the difference of the research in question being performed in a different institution. Information systems authors are cited heavily in theses with a medical librarianship bent, but not to the point of stretching the cluster as to find it intertwined with said topic.

It is interesting to note that the most prominent authors in each cluster do not tend to be located at the center of each cluster. Instead, they are skewed towards the center of the map itself, which the researchers take to mean that when a work is viewed as prominent in a certain topic, it becomes important for LIS in general itself, barring a few exceptions from very remote clusters such as citation analysis.

The fields of study as revealed in the clustering analysis of the data do not exactly match the tracks set by the SLIS curriculum—there are 14 clusters while there are only ten tracks. It was observed that management, collection development, and reference services have significant overlap, and citations which roughly fall under the umbrella term "user evaluation" is significant in all three. Information technology by way of systems analysis and design is a separate cluster from information systems- those which fall under the former tend to be development-based while those of the latter are more on evaluation of existing systems.

In short, the clustering does not follow the tracks as much as it follows specific, high volume topics within the tracks, some topics so varied as to produce two relatively well-separated clusters, namely that of system analysis and design or the development of software for libraries, and information systems evaluation.

The researchers encountered some problems while collecting the data such as:
1. Incomplete citations particularly in electronic sources.
2. Incorrect citation format where in some students confused APA style with cataloging format.
3. Some categorized e-journal articles as Electronic Source even if the SLIS Thesis Manual stated that it should be under Articles and Book Chapters.
4. Some Electronic Sources, such as online articles or PDF files were categorized under Articles and Book Chapters.
5. Some students used a different way of identifying reference type while one did not differentiate her citations.

The researchers decided not to manipulate or correct these issues while creating the citation index. Nevertheless, the citation index provided the researchers with a wealth of data to analyze.

In general, the researchers observed that the undergraduate students still rely heavily on the theses output of SLIS and LIS related reference, although electronic sources outnumbered the category of unpublished works in every year except 2014. By studying the journals cited by the students, the researchers also learned that the students cite journals from disciplines outside of librarianship depending on the nature of their research problem as reflected in their thesis titles.

Conclusions

The students heavily relied on electronic sources, which stem from their availability and ease of access through the internet. The local studies that were cited were dominated by citations of other SLIS theses. It is surmised that the student body's predilection for easy to get references affects their research output negatively, as the easiest papers to get might not be of the best quality.

The clustering analysis shows a core of references within which those theses which fall under the tracks of reference, collection development, and library management mostly gather, while other, more specialized topics such as citation analysis and thesaurus construction form clusters far from the core.

Although bibliometric mapping is ideal for eliciting a quick cognitive response due to its striking visual components, there is an inherent caveat to it in the sense that the understanding of the

data might not be as robust as when a careful application of other techniques is also employed. Thus, it is necessary to support bibliographic mapping with tables and pie charts and other customary presentations of data as to not only engage the reader but to give context to the visualizations.

Another caveat- given the many ways to visualize and present the data, one must be careful not to inadvertently omit important information which may be brought to light when a different presentation or visualization is chosen. In order to properly represent the data, careful analysis and a depiction of the bibliographic map on different zoom levels may be needed to show relationships and elements which an overall view might not be able to cover.

The popularity of an author as based on Google Scholar and thus their number of citations in other works does not seem to be important to SLIS students when they are choosing references for their theses.

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