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### Evidence-Based Practice in LIS: The Systematic Review

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# Evidence-Based Practice in LIS: The Systematic Review

*Claire Walker Wiley, Meggan Houlihan, and Amanda B. Click*

## INTRODUCTION

The authors of this chapter are regular research collaborators. Over the past decade, we have used a variety of research methods, from online surveys to photo-elicitation. Several years ago, we decided that we wanted to expand our research capabilities by exploring a new method: the systematic review. One of our goals was to really dig deep into the library and information science research. And if we are being totally honest, we also wanted to take a break from conducting research with human participants and all the Institutional Review Board (IRB) approvals and interview transcriptions that came with it. Over the course of two years, we designed, completed, and published the findings of a systematic review of the literature on academic libraries and international students.<sup>1</sup> Concurrently with writing this chapter, we are deep in the data analysis for a systematic review on information literacy in business librarianship.

This chapter provides an overview of the method, guidelines for study design, and the lessons we have learned during our own research experiences. Even if a systematic review is not an appealing or appropriate method for some practitioner-researchers, many librarians may find themselves in a support role for a systematic review conducted by other researchers or faculty members. Health sciences librarians and academic librarians are most likely to provide support for this method and may find this chapter particularly useful.

# THE SYSTEMATIC REVIEW

Systematic review is a specific and robust method of conducting a literature review. It is definitely not haphazard, as some literature reviews can be. Brettelle calls the systematic review “one of the key tools of evidence based practice for practitioners and policy makers.”<sup>2</sup> *The SAGE Encyclopedia of Social Science Research Methods* describes it in this way:

This methodology prescribes explicit, reproducible, and transparent processes for collating the best available evidence in answer to specific questions. In particular, it requires the use of robust techniques for searching for and identifying primary studies, appraising the quality of these studies, selecting the studies to be included in the review, extracting the data from the studies, and synthesizing the findings narratively and/or through pooling suitable quantitative data in meta analysis.<sup>3</sup>

Note that meta-analysis and systematic review are not synonyms but that meta-analysis can be part of a systematic review. Meta-analysis involves using statistical methods to combine the results of multiple studies and is generally used to synthesize quantitative research. Both quantitative and qualitative findings can be synthesized in a systematic review. As librarians in the health and medical fields know, the systematic review is a core part of evidence-based practice. They are very common in the health sciences. Historically, emphasis has been placed on randomized control trials (RCTs) as the “gold standard” of evidence, but this is shifting as researchers realize that sometimes other types of evidence are more appropriate.<sup>4</sup> In addition, RCTs may not be common in other disciplines in which the use of systematic review is growing.

## Appropriate Contexts

Systematic reviews have proved to be valuable for both policy-makers and practitioners in many fields. They are useful in many contexts, including situations in which

- there is just too much information available—a systematic review can distill hundreds of studies into a single article and bibliography on a particular topic;
- there are discrepancies in research—systematic reviews can often help us understand why findings are different between similar studies and determine the best evidence;
- you want to plan new research—contributing to the scholarly conversation requires understanding what is already being done and discussed; or
- you want to develop training or teaching materials—the robust methods of a systematic review reduce bias and thus provide more comprehensive coverage of a topic.<sup>5</sup>

The authors of *Systematic Reviews in the Social Sciences: A Practical Guide* describe some circumstances in which this method may not be the best choice:

- if the systematic review is not the right research tool to answer the question

- if there are already one or more good systematic reviews in the same area, which could more usefully be summarized or updated
- if someone is already carrying out a review in the same area, which is not yet published
- if the review question is too vague or too broad
- if the question is too limited in scope or narrowly (or wrongly) focused so that the results of the review are unlikely to be useful to researchers, funders, or other decision-makers
- if you or your institution have insufficient resources to support a reliable systematic review<sup>6</sup>

For example, if you do not have access to the majority of the research on a particular topic because your institution does not subscribe to the necessary databases, you will not be able to conduct a rigorous systematic review. If your research question is far too specific (e.g., How do librarians teach digital humanities to graduate students enrolled in history programs?) or the topic is too new (e.g., How do librarians and other scholars perceive Plan X?), it is likely that there is not enough research published on the topic to conduct a useful systematic review.

## Systematic Review in the LIS Field

Systematic reviews have been relatively uncommon in the LIS field (outside of medical librarianship), but are growing in popularity. The method can be particularly useful for librarians because systematic reviews can help us understand the research that is taking place in our field, identify and justify the most effective library services and support, and make efficient use of our own time by learning from others' studies instead of carrying out our own every time we need to make a decision.<sup>7</sup> Recent systematic reviews in the LIS field have explored the following topics:

- effects of face-to-face, online, and blended information literacy programs on student skills<sup>8</sup>
- developing the information literacy and academic skills of first-year health sciences undergraduates<sup>9</sup>
- assessment of outcomes in information literacy instruction<sup>10</sup>
- online health information literacy of health sciences students<sup>11</sup>
- the Dunning-Kruger effect in information literacy<sup>12</sup>
- student employment in academic libraries as a high-impact practice<sup>13</sup>
- instructional methods used by health sciences librarians in teaching evidence-based practice<sup>14</sup>
- linked data initiatives in libraries and information centers<sup>15</sup>
- research methods used in LIS research<sup>16</sup>
- effective information literacy instruction for engineering students<sup>17</sup>

Note that almost all of these studies, published between 2016 and 2018, focus on information literacy instruction. And information literacy for health sciences students, in particular, is a common theme.

## Steps for Conducting a Systematic Review

There are many sources that provide guidance for the systematic review researcher. The details may differ slightly, but the basic steps remain fairly consistent:

1. Define research question(s).
2. Develop guidelines for collecting the types of literature that will answer the research question(s), including inclusion and exclusion criteria.
3. Develop and carry out a comprehensive search plan for finding literature.
4. Develop a codebook and guidelines for coding the literature.
5. Critically appraise and code the literature.
6. Synthesize the literature.
7. Disseminate findings.

These steps are an amalgam of those recommended by two different sources; we combined and adjusted them to address the realities of LIS research.<sup>18</sup> For example, Petticrew and Roberts use the term “study” instead of “literature”: “Carry out a comprehensive literature search to locate those studies.”<sup>19</sup> We have found that much of the LIS literature does not necessarily qualify as original research. There are many items that simply describe a project, service, or program, and these are often useful for an LIS practitioner. We tend to include them in our systematic reviews even though they are not studies, which is why we chose to adopt Kelly and Sugimoto’s use of “literature” instead of “study.”

## DESIGNING AND CONDUCTING A SYSTEMATIC REVIEW

We recommend designing and conducting a systematic review following the seven steps listed above. Since some of the steps can be an ongoing process throughout the review, we do not want to suggest that when one step is complete you can truly move onto the next. In reality, researchers may be concurrently applying and developing the code, adding or deleting sources in which to search, or revising inclusion and exclusion criteria throughout the review. At a certain point in the study, however, steps one through four should be complete so that a consistent codebook and inclusion and exclusion criteria can be applied to the master list of items in the data set. For readers who are unfamiliar, a code is a word or phrase that is used to categorize the text or ideas found in a resource. The codebook is the compilation of all of the rules for coding that all reviewers should follow in order to maintain consistency in the review.

Not mentioned in the basic steps for conducting a systematic review, but an important consideration early on in the process, is assembling a team. The nature of this method requires frequent contact and communication with team members, and most of the actual work can be done remotely and asynchronously, which opens up potential for collaborators. For us, working together as a team has been one of the highlights of conducting our systematic reviews. We each bring unique skills, experiences, and perspectives to the

project, which makes for an enjoyable and productive environment. Finding individuals with whom you enjoy working, who are committed to a lengthy and time-consuming research project, and who have the attention to detail necessary for this kind of research will be essential for the success of any systematic review.

## Step One: Define research question(s)

Once you have determined that systematic review is an appropriate method for the general research idea, then you can define the specific research questions. Some familiarity with the literature surrounding a particular topic is necessary to understand the gaps in knowledge and avoid duplication of efforts. Petticrew and Roberts advise consulting with users who will benefit from the review during this step of the process.<sup>20</sup> This can help avoid asking questions that have already been answered and may lead researchers to more nuanced questions that will add value to the existing conversation.

In the LIS field, it's likely that a practitioner would choose to conduct a systematic review in order to inform the development of new services or programs. Thus, research questions will often be practical in nature: What is the most effective use of online tutorials for information literacy instruction? Which reference service model works best for supporting graduate students?

## Step Two: Develop guidelines for collecting the types of literature that will answer the research question(s), including inclusion and exclusion criteria

Questions to consider during this step of the review are the date range of the study, source types to include and exclude, and what topics are relevant and helpful in achieving the purpose of the overall review. Clear and well-defined research questions will aid in making decisions regarding scope during this step. As in step one, having some degree of familiarity with the norms of communication in a particular scholarly field is necessary to make appropriate selections regarding the scope of the study. Petticrew and Roberts note that “if the reviewer knows nothing of the area, then they are unlikely to know which questions most need to be answered, what research has already been carried out in the area, where to find it, and how to make the review useful to users.”<sup>21</sup>

The date range of the review should be chosen based on the overall purpose of the study. Is the review intended to show evolution in thinking over time? Is the goal to understand how a significant change in a discipline impacted practice? Or is the goal to determine current best practices? In our systematic review of the literature on international students and academic libraries, for example, our goals were to analyze trends in authorship, understand what topics are commonly discussed in the literature, and discover what research methods were most commonly used in this research. For these questions, a larger date range (1990–2014) was chosen in order to see long-term trends and evolution over time.

In our systematic review related to business information literacy, one of our goals was to understand how librarians have incorporated the *ACRL Framework for Information Literacy for Higher Education* into their teaching. In order to answer this question, we chose a date range that included significant time before and after adoption of the *Framework* in order to make comparisons (2000–2018).

Publication type is another scope-related consideration and is largely dependent on the overall goal of the systematic review. Do you want to examine the research trends for a specific topic or discipline, or do you want to focus more on practical findings that could be applied immediately? Kelly and Sugimoto's systematic review intended to identify methods and measures in the literature related to interactive information retrieval (IIR), so scholarly journals and conference proceedings were included and trade journals and magazines were excluded.<sup>22</sup> In our review of business information literacy, very few trade journals and magazines were identified in our searches. The specific trade journal and magazine articles that did appear were aberrations when considered next to the other scholarly resources identified, so we decided to exclude them. We did, however, decide to include peer-reviewed sources that were not necessarily research studies. We determined that peer-reviewed articles without a method section, which are common in the LIS literature, could contribute valuable insight that could help answer our research questions and should be included. In many fields, and especially in the health sciences, a systematic review will only include items that report on original research with a defined method—often RCTs. This is where being familiar with the literature and practice in a particular field will serve to inform the scope of the project.

## Step Three: Develop and carry out a comprehensive search plan for finding literature

Step three of a systematic review is to develop guidelines for collecting literature, including which sources to search and how to search them. The discipline and topic of a systematic review will influence the sources that need to be consulted. Kelly and Sugimoto developed “a list of journals and conferences that were believed to be most likely to contain IIR studies.” This list was then reviewed by four IIR experts and their suggestions resulted in the addition of other sources to include.<sup>23</sup> Petticrew and Roberts note that determining a stopping point for sources to include can be difficult. They advise that “funds, time, and logic” should inform researchers when they are making a decision about what sources should be consulted. Searching until there are less than 1 percent new results is one practical way to make a decision about a stopping point that can be applied to systematic reviews in certain disciplines.<sup>24</sup>

In our systematic review on business information literacy, we identified the top twenty-five journals in the LIS field as identified by LIS deans and ARL directors,<sup>25</sup> plus two additional journals that are focused exclusively on business librarianship. We looked at databases in which these journals are indexed in order to determine where to search. At

this stage, it is important to be aware of how various sources can be accessed in order to anticipate issues that may come up during the next stage of the review—data collection. For example, as we began testing searches related to business information literacy, we encountered some difficulty. Several of the journals we intended to include were not indexed completely in the databases we planned to search and would require searching individual publisher websites. In most cases, the publishers' search interfaces did not allow for the sophisticated search strategies we needed to use, which proved to be problematic. Because of this, some of the top twenty-five journals ended up partially or completely excluded from the search. While this meant that our review might not include relevant articles from these journals, we chose to prioritize consistency in our searches in order for the systematic review to be replicable.

Developing search strategies is the second part of this step. This process can take some trial and error, testing various keyword and subject heading combinations along with search techniques, such as truncation and Boolean operators, in order to determine which search will yield comprehensive results on a topic. Strategies will return varying results in different databases and search engines, so a variety of combinations should be tested while determining which ones should be implemented. In our first systematic review, we searched three library databases using a simple search of “international student” or “foreign student” in the title, abstract, subject terms, or author-supplied keywords. We added “foreign student” to the search after discovering that this was the subject term used in one of the databases we were searching. This simple search ended up being sufficient since the sources in which we were searching were already limited to the library literature.

Once you have identified sources and developed search strategies, you can put the plan into action. This is when the predetermined searches will be run in the selected sources and the master list of items to analyze will be compiled. While documenting decisions and processes is necessary throughout each stage of a systematic review, it is especially important to track decisions in the data collection stage. In each database search, it should be noted how many results were yielded, how many were kept and discarded, and the reasons why. In our systematic reviews, we divided the data collection work into thirds based on which person had access to which databases or publishers. For example, one searched Library & Information Science Source and Project Muse while another searched ScienceDirect and *Ticker: The Academic Business Librarianship Review*. In each source, we applied the agreed-upon search strategy, including date range and publication type limiters, and came up with an initial list of items to analyze. Results for the search were saved and exported into a central location to be combined with results from other sources. In our first systematic review, we used a Google spreadsheet to collect all of our search results, which meant a great deal of manual entry. In our second systematic review, we exported results into a shared folder in Zotero (a citation manager) when possible. Zotero allowed us to create a list of sources, which could then be pulled into a Google spreadsheet for analysis without the added work of manual data entry. After the searches are complete and records are compiled, you will be left with the primary dataset which is ready for analysis.

The items in your primary dataset will make up your “master” list and serve as the foundation of your systematic review. Depending on your inclusion and exclusion criteria, these

items may be journal articles, book chapters, conference papers, etc. Next, as mentioned previously, reviewers will divide the items and apply basic codes, such as author information and source type, all while removing items that do not meet the basic requirements of the study. Items that do not meet the criteria should be removed from the master list and kept in an additional spreadsheet that you can refer back to later. We recommend including the reason for removal, as well (e.g., not peer-reviewed, not actually relevant to the review topic).

## Step Four: Develop a codebook and guidelines for coding the literature

As in previous stages, the approach to the coding of results is largely dependent on the goal of the review. The fields identified for coding should serve to answer the overall question(s) of the review. In our systematic review on international students, we chose to code publication characteristics related to authorship, study design, and publication content such as key findings and recommendations. While the included fields and basic code options for each field were developed before we began the first round of reviews, the codebook evolved as we went through the review process. For example, when we first began coding items, we had only a few author types (e.g., librarian, LIS faculty, PhD student) identified as choices. As we went through the review, we encountered a larger variety of author types than initially anticipated, such as “other faculty” (education) and “other” (Army), so we expanded our options for this category and went back through the results to re-code this field with the new, expanded options.

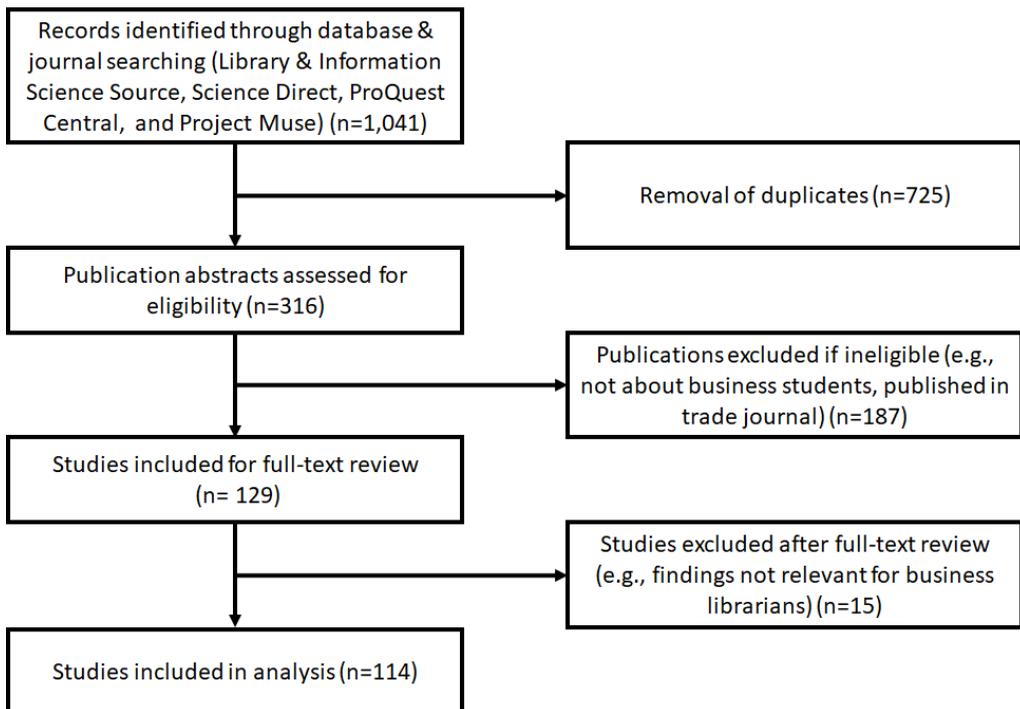
In both of our systematic reviews, we coded main topics for each item. While testing search strategies and preparing for the first round of the review, it is beneficial to begin thinking of common phrases, themes, and topics that appear in the literature if this is part of the review. These observations are the beginnings of a codebook that will be used to systematically code the final set of items with main topics. While the codebook will eventually need to be set in stone, it will evolve during the first round of data collection and analysis. During the coding process with both of our systematic reviews, we would often read a publication and come across a new topic that we wanted to add to the codebook. During the second round of coding, we would determine if the new codes are applicable to each item. While it is impossible to anticipate all topics that may come up during the review before beginning, having some codes identified prior to the first round of analysis can help minimize the amount of time spent going back over items in each stage of the review process.

## Step Five: Critically appraise and code the literature

Step five includes two rounds of analysis. During the first round, reviewers will screen all items that resulted from the searches, determining which meet inclusion criteria, and begin to apply the predetermined codes to each item that will be included. For us, in our international student systematic review, this meant looking at publication characteristics

such as source type, author collaborations, methods and theories used, and population studied. We divided our master list into three sections and assigned two reviewers to each section for this initial analysis. Once individuals coded their sections, we met with the other reviewer assigned to the section to confirm which items to include and codes for each field. The third reviewer was called upon to review any unresolved issues and agreed-upon codes were documented in the master list. At this point, each of us had looked at two-thirds of the total items.

Upon completion of the first round of analysis and initial coding, we reviewed the primary data set for a second round. The second round allows for deeper analysis of the items included in the master list. We chose to redistribute the items so that each of us looked at the one-third we had not analyzed in the first round. During this round of analysis, reviewers can look more closely at the item content, rather than item characteristics, to code fields related to topics, key findings, and recommendations. Reviewing items a second time is also the perfect opportunity to address issues and questions that came up in discussions after the first round of analysis. For example, in our systematic review of business information literacy, we noted that we should verify that pre-post tests were actually performance tests and not self-assessments and so rechecked the methods field in the second round of coding to clarify. During this step, researchers may want to consider using a qualitative data analysis software program such as Atlas.ti or NVivo in order to apply codes. This software allows users to load pdfs into the software, highlight text, and tag with a code from the unique codebook the user has created. This approach allows for optimal analyzation options during the next step: synthesizing the literature.



**Figure 18.1.** Flow diagram of item selection process

## Step Six: Synthesize the literature

Once the master list of items has been thoroughly analyzed and coded, reviewers can attempt to address the research questions they set out to answer. This step can take many forms of action. For somewhat simple questions, such as trends in methods used over time, reviewers can consider the date field against the method field and note historic trends. In order to analyze trends in author collaboration, the various types of collaborations can simply be tallied or viewed along with the date field to show what author types have been interested in the topic and when. For more complicated queries, such as identifying trends in key findings and recommendations, using qualitative analysis software is quite helpful.

If qualitative analysis software was used in the previous step to code the literature, then reports can be run for queries such as “What are the key findings that resulted from only those items with survey as the method?” or “Which recommendations are found in items that included a business faculty member as an author?” In our initial systematic review on international students, we tried to keep track of key findings and author recommendations on a Google spreadsheet, but we quickly found that this was an arduous process and lacked the precise language needed for further study. Thus, we imported all of the items into ATLAS.ti, and due to limited access to the software, one researcher went through all of the items and coded key findings and author recommendations. The two remaining authors divided the coded items to check for agreement. Learning new software isn’t always easy, but there are numerous online training opportunities and tutorials that can ease the transition. After various questions are explored, then the reviewers can draw conclusions.

## Step Seven: Disseminate findings

Earlier in the chapter, we provided some examples of recently published LIS systematic reviews. We’ve already mentioned the connection between this method and evidence-based practice, so it’s not surprising that a couple of these articles appeared in *Evidence Based Library and Information Practice*. Many of the examples tended to be published in highly respected LIS journals: *College & Research Libraries*, *Communications in Information Literacy*, and *The Journal of Academic Librarianship*. A well-designed systematic review can be high-quality, impactful research! It’s worth submitting your work to journals that are known for high-quality research—and have access to reviewers experienced with this method—so that you’ll be more likely to get valuable feedback that will strengthen your work.

We also recommend sharing your research at LIS conferences. This type of dissemination allows for conversation between practitioners and making connections with others who are interested in or experienced with this method. Of course, it’s probably best to match your systematic review topic to the conference. If you’ve reviewed the literature on information literacy classroom assessment, try for LOEX or the Library Assessment Conference. If you’ve reviewed the literature on library support for first-year students, maybe the Personal Librarian & First Year Experience Library Conference is your best bet.

## A Note on Software

There are numerous software packages that are designed to streamline the systematic review process. One of the most popular software packages, Covidence, allows users to import citations, screen items, and extract data, among other things. Covidence claims to save researchers an average of seventy-one hours per review.<sup>27</sup> The highlight of this resource is the ease of the initial screening. Instead of reading across columns in an Excel spreadsheet, as we did, the software compares two reviewers' results and only highlights points of difference. We tested Covidence with our business information literacy review, and we found that it wasn't as helpful as hoped. The software is clearly designed with the sciences in mind and made it hard to appropriately code LIS literature. We could have worked around some issues, but since we only had 114 articles, we decided to forgo the software. Health science librarians may find the software more useful. Other potentially useful systematic review software include DistillerSR and Rayyan.

Whether or not you decide to use a qualitative data analysis tool or systematic review software, we highly encourage the use of a data organization and management tool. We did not use one in our first review, and it definitely would have saved time and reduced duplication if we had implemented one. For our second review, we created a shared Zotero library that allowed us to store our search results from the databases, along with full-text items and citation information for each publication. This made the screening process very easy since only one person attached the publication, instead of all three of us searching for items. Quick access to items streamlined the coding process. Other citation management tools such as EndNote, Mendeley, and RefWorks would also be useful.

## REFLECTIONS

The systematic review is a robust method that can be a valuable tool for librarians—especially those interested in evidence-based practice. This method is particularly useful when a practitioner needs reliable information regarding a new (or existing, for that matter) service or support model. In addition, librarians who support the evidence-based research of others, such as faculty members or policy-makers, should be familiar with the method so that they are prepared to assist in developing search strategies, identifying sources, and recommending tools. Note that while we recommend that you follow the steps listed here, the manner in which you follow them may vary. For example, you may choose to manage issues around inter-rater reliability in a different way. This chapter offers recommendations and describes the study design choices that worked well for our team. Finally, we would encourage librarians who are interested in exploring evidence-based research methods to consider conducting systematic reviews in order to increase familiarity with this method in the LIS field. Below are some lessons learned while we worked on systematic reviews.

- Select team members who you believe will contribute effectively to the project and with whom you will enjoy working. Remember, this is a long and involved process that requires clear and constant communication.

- Establish a communication plan—how, when, and where should communication take place? You will be meeting with your team multiple times a month or week, depending on the pace of research. In our case, our team was separated by up to nine time zones so we decided to hold all of our meetings via Skype. Skype was especially useful for collaborating since we could easily share links and documents and, most importantly, it was free.
- Determine database access. Team members will need access to those databases that have been identified as sources in which to search. Not all team members need access to every database, however, but if none have access to a key source for the subject area, then this would be problematic. Lead researchers might consider access to databases as one criterion when assembling a team.
- Keep meticulous track of materials by implementing an organization system. We used Google Drive to create systematic review folders, one for international students and one for business information literacy. Within these folders, we stored all of our notes, outlines, timelines, codebooks, and research design documents. The collaborative features of Google Drive allowed us to simultaneously work on documents and access up-to-date materials at all times. Others might consider utilizing Dropbox or Amazon Cloud.
- Use a “live” research design document that outlines each step of the systematic review process. Throughout the review process, you will find yourself developing small points of clarity and refining code definitions. Every time we met to discuss the previous or next steps, we made notes about all of our decisions in this document. We found that if we didn’t write something down (e.g., the reason for excluding trade publications, why we added another category for research topics), we forgot it within a few months.
- Find a research tool that is right for your team. There are a plethora of useful research tools to assist researchers with the systematic review process, and it is important to evaluate and select the best tools for your specific project. There are three major areas to consider implementing a tool for: qualitative data analysis, systematic review process, and data management and organization. Our preferred tools were Google Drive (docs and sheets), ATLAS.ti, and Zotero.
- Understand the balance between flexibility and consistency with research design. When designing a study, researchers decide what, how, and where to search for primary data that will best answer their research question. If you’re not interested in tracking authorship trends on a specific topic, then there’s no need to record this as a field. Once you begin the review process and decide on the inclusion and exclusion criteria, however, it is important to strictly adhere to criteria and follow the research plan accordingly.

## NOTES

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