

Kirmser Undergraduate Research Award Essay 2014

Josh Dotson, Ryan Cater, Tian Bai, Taylor Stein, Jason Steuber

Kansas State University

Introduction

Jumping into the deep end of a research paper can invoke in students a feeling of drowning in information. Thankfully, K-State's libraries have provided students with research tools to stay afloat. Also, developing research strategies enables students to navigate through the deep seas of information. After utilizing all of the resources available, students will realize that research is an adventure and not a struggle to keep from sinking.

Last semester, our professor assigned us a final project in heat transfer to design a single-phase, microchannel heat exchanger (MHE) that will dissipate $500 \frac{W}{cm^2}$ from a 30mmX10mm plate and to develop an experiment to test our model. We were required to use three sources or more. This essay will outline our research strategies and the tools that we used to meet our professor's requirements. Also, this essay describes a way of evaluating and organizing sources.

Research Strategies

Our research strategy was one that moved from general to specific information. This movement created a natural research strategy in two ways. First, our topic was constantly being refined. Second, we were able to use a broad variety of resources that are available through K-State's libraries. The resources that we used are divided into two categories: books and databases.

Topic Refining

Although topic refinement is a continuous effort, we observed three distinct steps of refinement. First, preliminary exploration of the topic was accomplished through in-class

lectures, reading the class textbook, and completing homework assignments. The textbook is not specific to MHEs. Therefore, we narrowed our search by looking in the library. Again, we found that the books at the library did not have specific information for MHEs. Finally, we concluded that the majority of our research would come from journal publications because the information about MHEs was so new.

Books

Three ways of using books for research were discovered: class textbooks, local library books, and interlibrary loan books. Initially, we used the class' textbook for generalized and fundamental information. The textbook established a strong foundation for us to begin our research.

Next, we made an attempt to find relevant books using K-State's local library. We began by searching the online library catalog for 'heat exchangers.' We observed that many of the search results had similar card catalog numbers. Using this observation, we went to the library and found that many of the heat exchanger books were located in the same stack. Therefore, we were able to physically browse for books that might have been overlooked by using the online library catalog. Unfortunately, we discovered that the locally available books were not specific enough, and they provided information that we previously acquired from our textbook.

Lastly, we used interlibrary loan to find a hard-to-find book. We learned of a book that was an industry standard for the topic we were studying. Unfortunately, K-State's library did not have the book. Unsure of how to get the book, we asked Alice Trussel, librarian at the Fiedler Engineering Library. She explained to us that the "Get It!" button would automatically link to the

interlibrary loan request page with the book's information entered in. We sent the request and received the book in two days.

Databases

Our second searching technique was to find a database that would contain technical articles about our topic. Fortunately, the library's website organizes databases according to discipline. After selected Mechanical and Nuclear Engineering, we found a database called Scopus.

We found multiple reasons to use the Scopus online database. For example, all articles by a specific author can be listed on a single page. Also, statistics about articles and authors can be viewed using the Author Evaluator, Citation Overview, and h-Graph. These tools helped us quickly find the most relevant and credible articles available.

As an example, we searched for our professor with two search fields: author name (Betz) and keyword (microchannel). Next, we selected her name to view all of her publications on a single page. After finding a relevant publication, we selected it to view its statistics. For us, the most useful statistics were the reference and the number of citations per reference. We used multiple references that were relevant to our study that had over 1000 citations each.

Evaluating and Organizing Sources

While researching our topic, we determined what information to use by its level of credibility and industry approval. Also, we used RefWorks to keep track of our sources and to create our bibliography.

Information was used if it contained a high level of credibility and industry approval. For example, our textbook is credible because it was written by a professor with a PhD, it is highly cited, and it has been around for a long time. Also, the articles that we found are credible because they were written by people in the industry that have PhDs, they are published in academic journals, and they are highly cited. Therefore, all of the information that we gathered can be trusted and is of the highest quality.

While gathering information, we needed a way to keep track of our sources and accurately create a bibliography. RefWorks provided three ways to help us. Initially, it helped us by saving and organizing all of the sources that we used. Next, RefWorks helped us automatically create bibliographies. Finally, we used RefWorks' in-text citation tool for Microsoft Word. RefWorks allowed us to focus more on the research and less on the bibliography and citations.

Conclusion

We learned a great deal about the tools available to students at K-State's libraries. First, we learned that when the libraries do not have a specific book, interlibrary loan can get the book for us. Second, we found that Scopus is a great tool for finding highly technical articles that are credible. Finally, we learned that Refworks is a great tool for keeping track of sources and creating bibliographies. Our experience researching MHE has been educational in two ways. First, we learned about heat exchangers. Second, we learned how to create a strategy and use library tools to keep our heads above water in the vast sea of information.