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Jennifer L. Groff
Clemson University, jgroff@clemson.edu

Meredith Futral
Clemson University, mfutral@clemson.edu

Patents and Market Research: Librarians Partnering to Assist Bioengineering Senior Design Teams

Jennifer Groff
Engineering Librarian
Clemson University
jgroff@clemson.edu

Meredith Futral
Business Librarian
Clemson University
mfutral@clemson.edu

Clemson's business and engineering librarians have partnered to create a two-step, efficient process to assist Bioengineering Senior Design students in understanding patents and patent searching and market research. Clemson University's required two-semester Bioengineering Senior Design program matches teams of students with regional clinicians to develop biomedical devices that they research, design, prototype, and test. In the first semester of the program, in which the business and engineering librarians are involved, students take BioE4010-Bioengineering Design Theory. BioE4010 is offered in both the Fall and Spring semesters, but enrollment is significantly higher in the fall. For example, in the Fall of 2021 the business and engineering librarians assisted a record 21 design teams of 4-5 students each, but there were only five design teams in the Spring of 2021. In BioE4010, teams must conduct a market analysis and identify competitors for their planned devices. They then search for existing related patents and published patent applications and reflect on how prior art could impact the patentability of their devices. The business librarian provides instruction in market research and the engineering librarian focuses on patents.

First, the business and engineering librarians visit each Bioengineering lecture class (usually two per semester, an hour and fifteen minutes each) in person or over Zoom. A BioE 4010 course guide (https://clemson.libguides.com/BioE4010) with "patents" and "market research" pages serves as the starting point for instruction. Table 1 provides an overview of the class agenda. The business librarian begins by showing the students how to locate the BioE 4010 course guide and then provides about twenty minutes of short introductions to several market research databases the students will need to use for their analysis, including MarketResearch.com Academic, Business Insights: Essentials, IBISWorld, and MarketLine Advantage. This leaves five minutes to mention and look at three company databases, Mergent Online, Business Insights: Essentials, and MarketLine Advantage.

Next, the engineering librarian gives a brief 15-minute presentation about the types of patents and the patenting process. The engineering librarian then demonstrates brief (five minute) patent searches in both the USPTO's patent databases (PatFT and AppFT; this will change given the launch of Patent Public Search) and Google Patents, and then spends more time (fifteen minutes) focusing on the advanced patent search capabilities of Espacenet. In Espacenet, patent searches are done by keyword and Cooperative Patent Classification (CPC) schemes. Students are also shown how to search for patents using the names of competitors they have already identified via their market analysis project, and how to filter their results to United States patent documents, if desired.

Table 1. Class Agenda

Librarian	**Activity or Database**		**Time (Minutes)**
Business/Market Research Librarian	Databases for Market Research:	MarketResearch.com Academic	20
		Business Insights: Essentials	
		IBISWorld	
		MarketLine Advantage	
	Databases for Company Research:	Mergent Online	5
		Business Insights: Essentials	
		MarketLine Advantage	
Engineering/Patents Librarian	Powerpoint Presentation: Patent Basics		15
	Databases for Patent Searching:	USPTO's PatFT and AppFT	5
		Google Patents	5
		Espacenet	15
Total Instruction Time (Class time is 1 hour 15 minutes):			**65**

Following the introductory in-class lectures, student teams are required by their professor to meet with both the business and engineering librarian to receive more tailored assistance with their market research and patentability assignments. These consultations are done independently. Students schedule appointments using LibCal, a web-based Springshare product for libraries to manage calendaring needs**;** most are 30-minute appointments but a few teams book one-hour appointments. These meetings all take place over a 2–3-week time period, either over Zoom or in person depending on the team's preference. If teams do not include a brief synopsis of their devices when scheduling their meetings, the librarians reach out to the teams to request a brief summary, to be better prepared for the team consultations.

The business librarian uses the information provided by the teams about their devices to identify the most useful databases to focus on for each team. In general, when the teams meet with the engineering librarian, many of them have already begun their patent searches and need help refining their search terms to find more relevant patent classifications and patent documents. The librarians do regularly encounter some challenges in managing student expectations. For

example, students often want the engineering librarian to give them advice on whether the devices they are designing are novel enough compared to the technology in existing patents that they find. When this happens, students are encouraged to discuss this with their clinicians and professor. On the market research side, students often hope to find a report written about their specific devices, but these don't often exist or if they do, Clemson Libraries might not have access to the reports, which often cost thousands of dollars. Instead, the business librarian will show the students how to find reports that are available in the databases and as closely related to their device as possible. Sometimes the available market research reports are broader in their content.

In the Fall of 2021, Project Outcome (a free surveying toolkit for academic and research libraries provided by the Association of College & Research Libraries) was used to assess the initial whole-class lecture sessions. Survey feedback was received from 27 students and was overall positive. 96% of respondents felt that they learned something new to help succeed in their classes and felt more confident about completing their assignments. Two students commented that it would be useful to have these resources introduced earlier in the Bioengineering curriculum, and this is starting to take place. The engineering librarian was invited in the Fall of 2020 and 2021 to talk to a sophomore level Bioengineering Professional Development class about resources for bioengineering, including patents, so hopefully librarian involvement in the Bioengineering curriculum will continue to grow. The Bioengineering professor who leads BioE 4010 in the Fall semesters also provided positive feedback to the librarians, writing that when students presented their work, "it was clearly evident that your meetings with them improved their learning and content outcomes".

In conclusion, the engineering and business librarians would like to use what they have learned to become more involved with other senior design programs at Clemson University in the future. As one example, Materials Science and Engineering has a Senior Capstone Design class, MSE 4070, where collaborations also exist between industry and student teams. The Engineering Librarian has given lectures to this class about patent basics and patent searching in the past, but in the future the Business Librarian's market analysis expertise will also be offered to the MSE 4070 professor. Besides Bioengineering and Materials Science and Engineering, neither librarian is currently involved with senior design programs in other disciplines at Clemson University. Additional future outreach efforts will hopefully expand the library's patent and market analysis instruction into additional engineering senior design programs.