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Student Information Use and Decision-Making in Innovation Competitions and the Impact of
Librarian Interventions

Abstract

At a large Midwestern university, librarians work closely with an annual undergraduate agricultural innovation competition to guide students through the process of conducting market research and assessing patentability. In 2018, the authors conducted an exploratory study using focus groups of students who had participated in that year's competition in order to learn how students find and use information in a competition setting, to evaluate the impact of library support on the students' success, and inform further assessment activities. Results showed that students used information from the library and from their own research, notably seeking out first-hand expertise, to practice evidence-based decision-making.

Introduction

Since its inception in 1994, the annual Purdue University Student Soybean Innovation Competition has given students the opportunity to apply research and entrepreneurial skills to create new uses for soybeans. The competition focuses on developing new products from soybeans to foster environmental stewardship and reduce reliance on petroleum. This competition is a cross-disciplinary and multi-departmental effort to foster student innovation. The competition is a form of experiential learning, allowing students to fully experience the product design process and practice making evidence-based decisions. Agriculture, business, and patent information is used throughout the competition in a myriad of ways, including understanding how soybean components can be used, determining the market and impact on soy production, and in creating a prototype of the product itself. Librarians are heavily involved in assisting the students with gathering and using this information, with direction consultation-based instruction and an online competition research guide (Howard & Zwicky, 2018). This exploratory study presents the results of focus groups of students who had competed in the competition in order to learn how students find and use information in a competition setting, to evaluate the impact of library support on the students' success, and to inform further assessment activities.

Background

The Soybean Innovation Competition is a collaboration between Purdue University's College of Agriculture and the Indiana Soybean Alliance (ISA). The ISA provides funding in exchange for new ideas for soy-based products, which will ultimately increase demand for [state] soybeans. Purdue University students receive the opportunity to experience the product development process firsthand. The winner of the first competition in 1994 was a soy-based

crayon, which was licensed by Dixon Ticonderoga and is currently produced under their Prang brand (Haney & Tally, 2002). The competition is very high profile with large prizes: the winning team receives \$20,000 and support from the ISA for commercializing their product, the second-place team receives \$10,000, the third-place team receives \$5,000, and the remaining teams receive a variety of rewards and incentives for participating. It should be noted that all teams finishing the competition have the option of pursuing commercialization.

Purdue University Libraries became involved the second year of the competition and, since the mid-1990s, a patent and trademark librarian and a business librarian have helped support the information needs of the participating students. The current program director places great importance on librarian involvement and encourages student groups to take advantage of consultations with the librarians. In recent years, between 20 and 40 teams have participated, with a patent librarian and a business librarian consulting with a majority of the groups.

Competition Specifics

In its current form, the competition consists of four phases. The first, beginning in October, includes recruiting and forming teams. During this phase, a business and patent librarian attend the first all-team meeting and briefly discuss the types of information available and the benefits of setting up an appointment with each librarian. The second phase covers the ideation process, in which students brainstorm ideas and test the commercial viability of their products, and it runs through November. Librarians have the most involvement in phase two, meeting with the student groups individually to help with patent and market research. The third phase is spent determining the technical feasibility of the product, and students spend much of this time in the lab designing a workable product prototype. After phase three, there is a preliminary judging round, in which teams who are unlikely to finish their products are

eliminated. The remaining teams move on to the fourth phase to complete their prototypes, design a packaging concept, and complete their final reports and presentations. In early March the students present their completed products to a panel of judges, assembled by the ISA. The teams are judged based on their reports, presentations, and prototypes, and the judges primarily focus on the commercial viability of the product and how many soybeans it will help sell.

Literature Review

Academic libraries have an extensive history of supporting experiential learning, whether through the framework of a competition or in a variety of other settings. This includes library support for internal initiatives like makerspaces and device lending (Barrett et al., 2018; Cross & Tucci, 2017; Rogers, Leduc-Mills, O'Connell, & Huang, 2015), as well as classroom-based activities like client-based design and active learning projects (Ishak & Ong, 2016; Spackman, 2016). Service learning, experiential learning that emphasizes civic engagement (Lim & Bloomquist, 2015), is both supported by libraries (Herther, 2008) and used by libraries to connect with their local communities (Heiselt & Wolverton, 2009). Sanders and Balius (2015) surveyed the library and information science literature between 2005 and 2015 and compiled an annotated bibliography, illustrating the broad range of activities covered under the overall umbrella of experiential learning.

Today's students are attempting to learn how to make decisions in a time of information overload. Though the amount of information available can be overwhelming, it does not have to be a hindrance. Although case studies have been a traditional and effective method of teaching business students, McCarthy and McCarthy (2006) argue for mandatory experiential learning programs across the business curriculum, as case studies cannot provide the same type and level of learning that occurs through experiential activities.

Experiential learning also puts learners into the position of finding information in a specific context. The field of information behavior looks at information use and nonuse, how information is processed, and reasons why this may be unsuccessful (Case & Given, 2016), specifically through the lens of the searcher, creator, and user of information (Ellis, 2011). Agarwal, Xu, and Poo (2011) found that source quality is relevant to information seekers when the task that requires the information is important. They also found a strong preference in order of the use of sources, with online information and face-to-face interactions being the preferred types. In later work, Agarwal notes that context in information behavior “is all about relationship – of an actor with elements outside of the actor (people, artifacts, processes, situations, environment) or even of the actor with themselves” (Agarwal, 2018, p. 125).

Academic librarians support students in the context of entrepreneurship and innovation in a myriad of ways, including entrepreneurship-focused curricula within engineering and business schools (Kirkwood & Evans, 2012). Libraries are also increasingly involved with or home to makerspaces on campus, serving as a multidisciplinary shared space (Barrett et al., 2018). Additionally, libraries are building relationships with business incubators, centers for student entrepreneurship, etc. (Hoppenfeld & Malafi, 2015), and partnering with community entrepreneurship programs, such as the Entrepreneurship Bootcamp for Veterans with Disabilities (Hoppenfeld, Wyckoff, Henson, Mayotte, & Kirkwood, 2013). Libraries also purchase and provide access to many business information resources, such as company, market research, and business news databases.

While the literature on support for student entrepreneurship and innovation competitions is limited, to say nothing of the literature on more narrowly focused competitions featuring specific materials, multiple academic libraries have pages on their websites describing the

support available. The University of Utah's Bench to Bedside is a multidisciplinary competition focused on solving problems facing clinicians, with libraries supporting students through workshops on topics like intellectual property (University of Utah Health, 2018). Georgia Tech has a more broadly technology-focused competition called the InVenture Prize, with libraries again providing support on intellectual property topics (Georgia Institute of Technology, n.d.). In addition to technology and invention competitions, libraries also support case competitions, in which students attempt to solve problems facing real-world businesses (Stonebraker, 2017).

Patents, the form of intellectual property that protects inventions, are both tools in the entrepreneurial sphere and sources of rich technical information. While the specifics may vary in different jurisdictions, patents allow entrepreneurs to determine if someone else already owns the invention they intend to bring to market, in whole or in part (United States Patent and Trademark Office, n.d.), and to find how other inventors have attempted to solve a particular problem, whether or not a given solution was ever commercially viable (Phillips & Zwicky, 2017; Whittemore, 1981). Both uses of patents can aid in the decision-making process. However, in order to find this information, inventors must learn how to effectively search for patents, using specialized resources (Meier, 2015) and techniques beyond simple keyword searching (White, 2010). Librarians are well-situated to provide this instruction.

In this competition, librarians work with students to use the principles of evidence-based decision-making when making business decisions, such as determining which product to focus on and attempt to take to market. Evidence-based decision-making stems from the health science field of evidence-based practice (Tranfield, Denyer, & Smart, 2003) and is now the separate discipline of evidence-based management (EBMgt). EBMgt was developed to help bridge the gap between management research and practice (Rousseau, 2006; Rynes & Bartunek, 2017),

making it a natural fit for experiential learning. There has already been success with teaching evidence-based decision-making in multiple management education areas, including human resources, doctoral education, MBA programs, and in a first-year management classroom (Jelley & Carroll, 2012; Salipante & Smith, 2012; Stonebraker & Howard, 2018), so it was a natural progression to extrapolate this type of instruction in a consultation model. The experiential learning environment of a competition gives students the opportunity to practice evidence-based management.

Research Questions

Winning teams from the last two years consulted with both the business and patent librarian multiple times. Some studies have shown that interactions with librarians have a positive correlation with student success (Association of College and Research Libraries, 2015, 2016, 2017; J. M. Vance, Kirk, & Gardner, 2012). This paper seeks to examine the connection between interactions with librarians, information use, and success in the Soybean Innovation Competition by exploring the following questions:

1. How do students find and use information resources for innovation competitions?
2. How do students incorporate information into decision-making within innovation competitions?

Methods

Ten students participated in focus groups, across two sessions (seven in the first, three in the second). The small focus group method was chosen in order to get initial feedback from participants to help inform future research. All 10 of these students had participated in the most recent competition, which had ended the previous month, and three of the students had been on winning teams over the previous two competitions. Six had met with one or both of the

librarians, and four had met with neither. All were selected via convenience sampling with the help of the competition director. Of the participating students, one was a graduate student and the other nine were undergraduates. Two of the participants were international students. The gender split was six men and four women. While three of the participants had been first-time competitors that year, the other seven had participated in multiple years of competition. Students did not receive compensation for participating in the focus groups.

The focus groups were organized by the investigators, with assistance from the competition coordinator and conducted by members of the library staff, using best practices outlined in *The Focus Group Research Handbook* (Edmunds, 2001) and *Using Focus Groups in Research* (Litosseliti, 2007). The format for the focus groups was semi-structured, with five primary questions and a number of suggested follow-up questions (see the focus group protocol in Appendix A for the list of questions). The investigators then transcribed the interviews and prepared a preliminary code book using thematic analysis until saturation was reached and no new codes emerged (see Appendix B). The transcripts were then coded separately by two other members of the library staff, unaffiliated with the competition in order to reduce bias, and then compared to provide inter-rater reliability. These coders found several additional emergent codes and the resulting data were passed back to the investigators for norming and analysis.

Results

The coding of the focus group transcripts was broken down into three categories. The first was a cluster revolving around the general use of information, including the need for a personal connection and the use of primary sources, the second revolved around the students' decision-making process, and the third related to how the students wished to receive information.

General use of information, need for personal connection, and primary sources

In addition to using secondary sources, many of the groups also did their own primary market research and looking for personal connections to gather information, including friends, family, and community members. Part of this was due to the specific information they needed not being available in a library-held market research report, but in some instances the students seemed to prefer the personal connection in talking to another person about their project, with one student commenting, “what I ended up doing, usually doing, is I tried my best to find people that had those answers.” Another student struggled to find the resources they needed online and so sought out personal connections to get the answers. Several students simply noted that they preferred to talk to someone one-on-one in order to get basic information, as opposed to “Googling blindly,” and to develop their understanding of their markets beyond the theoretical. As one student put it:

I had to go out and ask. I asked for examples... I was able to find small examples, large examples... so I was able to find how fast they could do it, how well they could do it, and then I was able to use that basic information to help develop the cost-benefit analysis, so I could compare our products to other products out there.

Students repeatedly described taking their research beyond the required literature sources, seeking out experts for one-on-one conversations and even making their own observations in the field. One student described investigating possible applications for their food-related technology, saying “For our group we just went to the supermarket and then see [*sic*] which product is, has large demand for daily groceries, because we like a market that covers daily life, or like a majority of demand that people would want.” Another told a story about a teammate calling local businesses to determine how much they could charge for their invention, saying

He just started calling, and he probably called dozens of... local contractors and some larger ones just to get specific numbers, and that made a very big difference when we went into the final report and the presentation, because [we] had a list of actual companies and the revenues... and we were able to price our thing realistically.

Facing a lack of published business information, another student stated “Yeah, we kind of went to the hog farm and asked them questions about marketing.”

Decision-making and Ideation

Students reported using information to help in decision-making and ideation throughout the competition, both in choosing and refining their ideas. One student who had previously participated in the competition talked about front-loading the research process so they would be able to make changes early based on the information they discovered. Another student talked about contemplating a new product near the end of the competition, then finding information that confirmed their decision to go with their original choice.

The students also talked about the impact of librarian consultations on their decision-making process. One student discussed the benefit of meeting with the business librarian early in the project to help come up with marketable ideas, then meeting with her again to help make marketing determinations:

And then for market, we met with Heather [the business librarian]... twice, my second year. We did not meet with her at all the first year, which was a big mistake, as I said... In hindsight, I would tell every team going on in the future, meet with Heather [the business librarian] [...] when you haven't even started the project, practically, to help understand where soy can go. And then once you actually have a decent plan, maybe meet with her

again [...] when you're actually putting together the market report. But we didn't meet with her anywhere near as soon as we should have.

Another group discussed how a librarian consultation helped further refine their idea from a broad concept to a marketable product:

And then after actually looking at the market, and we had met with Heather [the business librarian], who is, helps with marketing, she said you want to do something that can help distinguish your product, and so then we thought about how soy has more density, and that's how we got to the weighted blanket. So we weren't originally weighted blanket, we were just insulation first.

One group talked about the missed opportunity of information that could have been provided by the business librarian, noting they met with her initially, and should have met with her again when determining how to market their product for different applications. Another group found out during a consultation that the costs on the product they would be replacing with soy were already so low, it didn't make sense to try and create a new soy-based version.

Instructional Preferences

Students who chose not to meet with the business and patent librarian faced many information challenges, including an inability to find and understand information.

Overconfidence was often cited as a reason for not scheduling a consultation, with a student commenting, "My team didn't ever meet in person with Dave [the patent librarian]. I sent him an e-mail with a couple of questions, but we didn't have too much trouble with the patent search, finding patents for our product, because adhesives are everywhere. The trouble we had with patents was understanding them. But we got there eventually, I guess."

Students also requested more information on the technical applications of soybeans. Currently, only the business and patent librarians are working with the competition, but there is clearly room for the addition of information from the agriculture librarian. Students also requested more time and attention from their competition faculty advisors, noting they felt like they were often working blindly on their own. Some students also did not retain information from the original competition meeting at which the libraries spoke, commenting, “I think the libraries should be better utilized. If you can point out the benefits, where you benefit from using libraries. I think it's as simple as showing up at the meeting and showing the resources.” Another student requested instruction online, rather than in person, noting, “I think an hour video would be better than a lecture in person. I would like it. That's how I learn, I like watching videos online.”

Discussion and Conclusion

The experiential nature of the competition allows for students to directly connect their research to business outcomes and product creation. Students were often able to successfully find and use information to make evidence-based decisions about ideation, product refinement, design, and marketing. Though students are often overconfident in their information seeking capabilities, our observations align with those of McCarthy and McCarthy (2006), in that students are able to learn much more through an experiential process than they would with a simple case study. Though the emphasis of this competition was not service learning, we found that students did this on their own through their primary research and outreach to the community, providing the additional outcome of civic engagement. As this was unexpected, this is an area for librarians to examine further in the future so as to best support these efforts.

Librarians working with students in the competition help them find information sources that will help them determine patentability and marketability for their products. This can include market and industry reports, competitive intelligence resources, government websites, and more. These focus groups found that students showed a willingness, and even a need, to go beyond traditional literature searching in their approach to business information research. Often the products the groups developed were niche or unique, so specific information on their ideas was not available. Rather than making do with related or tangential business information, students reached out to people directly, which aligns with the information seeking behavior preferences found by Agarwal (2018). By seeking out first-hand expertise and speaking with active practitioners in the field, they were able to ask specific questions and receive specific answers directly related to their projects. This preference for consuming and processing information appears to align with the comments about watching online videos and in-the-field learning, in a search for more “authentic” learning experience (Herrington, 2006; Reeves, Herrington, & Oliver, 2002). Flierl et al. (2018) observed a similar preference with respect to person-to-person interaction, as did Sheppard and Vibert (2016) with respect to video content. While these focus groups were not able to dig too deeply into this phenomena, it is something that may warrant further exploration in future studies.

Students also showed an ability to follow the tenets of evidence-based decision-making, using the information they gathered to make informed decisions throughout all phases of the competition. Librarians supporting the competition can improve their practice by learning how to best meet the student’s information needs with agriculture, business, and patent information that can help at crucial decision points in the competition.

Limitations

This study had the small population size of a single competition and the methodological disadvantages of focus groups. Limitations of focus groups include the population being self-selected and moderating outspoken individuals to prevent them from hijacking the conversation. Despite these limitations, this methodology is still useful to gain an understanding of information use by students in this competition.

Future Work

Through this process, we have been able to develop an information pre and post test to help determine what skills students are developing throughout the competition. We also hope to do a longitudinal study to determine the career impact of participating in an innovation competition as an undergraduate, and look at the impact on different demographics. Additional studies could be done comparing these results to the student populations competing in other innovation competitions, and determining if the experience is limited to this competition, or is more global. We also hope to learn more about the service learning and civic engagement taking place in the competition. In response to the results of this initial study, we plan to integrate additional agriculture information and increase our outreach activities to encourage additional consultations. We hope to continue to hone our work to best support student innovation.

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Appendix A: Focus Group Script

1. Focus Group Intro

- a. Greeting
 - i. Hi, I'm _____. Welcome and thanks for taking the time to help us out.
- b. Purpose of focus group
 - i. We're here to discuss your experiences in the soybean competition and dig into your research process
 - ii. What you tell us today could be helpful both for our research and for improving the experience of future soybean teams
- c. Ground rules
 - i. Speak your minds -- there are no right or wrong answers, all points of view are important -- we're not here to build consensus or find the "right" answer
 - ii. Role of the moderator -- I'm here to facilitate. I don't have a lot of prior experience with the competition.
 - iii. Recording -- I do want to point out that this will be recorded. We'll do our best to make sure anything we use will be reported anonymously, but we cannot guarantee complete confidentiality
 1. Please speak clearly and one at a time. That will help us out.
 - iv. Time -- This should take about an hour.
- d. Getting to know each other
 - i. Could you introduce yourself. Tell us about your name, your major and current year in school, and how many and which years you've participated in the competition.

2. Research Question Script

- a. What was your process in terms of gathering information for this competition?
- b. Did any information you found change the direction of your project?
 - i. How so?
 - ii. Where did you find that information?
- c. Did your group meet with the business or patent librarian?
 - i. If not, why not?
 - ii. If so, which one and at what point in the project?
 - iii. Did the consultation impact your project?
- d. Did you have any information challenges in the project?
 - i. Could you give some examples?
 - ii. How did you resolve these challenges?
 - iii. What resources and/or services could have helped make these challenges easier to resolve?

3. Wrap Up/Closing

- a. Is there anything else you'd like to share?
- b. Closing comments
 - i. Thanks for your participation
 - ii. Compensation details

Appendix B: Codebook

Initial codes

1. [Resources] Information resources - This includes specific databases, websites, and people where students found information.
2. [Instruction] Library instruction - Meeting with business or patent librarian.
3. [Decision] Decision-making - This includes any time students used information to change the course of their project.
4. [Recommendations] Recommendations & improvements - This can apply to the libraries or to the competition as a whole.
5. [Patent] Patent research - This is any discussion of patent searching tools or techniques, and any discussion about obtaining or reading a patent.
6. [Market] Market research - This is any discussion of market searching tools or techniques, and any discussion about defining a market.

Emergent codes

7. [Primary] Primary source information - This is any time students did their own primary market research rather than relying on a market report.
8. [Ideation] Design - Ideation - This is the process of determining if an idea or product is worth pursuing.
9. [Refinement] Design - Refinement - This is the process of iterating on the design, refining and improving it towards its final form.
10. [Implementation] Design - Implementation - This is the process of putting the design into practice, in this case creating the prototype.

Coder-added codes

11. [Challenges]