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**Impact of Library Information Literacy Training on Entrepreneurship Competition Scores:
A Quantitative Study at University of California, Irvine**

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Abstract

The University of California, Irvine's (UCI) Innovation and Entrepreneurship Librarian partnered with UCI's New Venture Competition to provide embedded research support for teams participating in the competition, including a research workshop and individual team research consultations. To assess the impact of these library services, a quantitative study of three years of competition scores was conducted involving a control group and two experimental groups; the difference in the experimental groups was the mode in which the services were provided: in-person and virtually. The study hypothesized that teams who received information literacy training (i.e., attended a research workshop and/or participated in a research consultation) earned higher *Concept Paper scores*, as well as higher *evidence question scores* (i.e., scores for a rubric question related to providing evidence in support of claims made in the Concept Paper), than teams who did not receive information literacy training. Statistical analysis showed significant increases in both *Concept Paper scores* and *evidence question scores* for both experimental groups when compared to the control group, indicating that information literacy training positively impacted teams' performance. Additional analysis revealed no statistically significant differences in teams' scores based on training delivery mode, in-person or virtual. The results are of value to librarians seeking to initiate partnerships with entrepreneurship competitions on campus, as well as entrepreneurship educators interested in enhancing existing entrepreneurship competitions by incorporating research and information literacy training.

Keywords: entrepreneurship, information literacy, entrepreneurship competition, embedded librarianship, academic libraries

Impact of Library Information Literacy Training on Entrepreneurship Competition Scores: A Quantitative Study at University of California, Irvine

The recent surge in entrepreneurship activity at higher education institutions across the country has produced a community with unique information needs, which has directly impacted academic libraries. As Toane and Figueiredo (2018) explain, “campus entrepreneurs seek information to inform their ideas, validate their assumptions, and reduce their risk” (p. 36). Entrepreneurial research can include broad categories such as industry, market, company, funding, and intellectual property research, which are often challenging to navigate and may require expensive subscription databases and other resources. This growth has created an opportunity for libraries and librarians to provide valuable research support and play a critical role in the campus entrepreneurial ecosystem.

As with other subject librarian roles, entrepreneurship librarians, or librarians who support entrepreneurship in addition to complimentary subject areas such as business or engineering, provide a variety of services to support the research and information needs of this community. The services identified by these librarians as being most important in working with entrepreneurs include research services (reference), engagement (outreach), and teaching and learning (instruction) (Toane & Figueiredo, 2018). For librarians supporting entrepreneurship, these services are often intertwined. Embedded reference and instruction services, in particular, are popular forms of outreach for librarians supporting campus entrepreneurship groups, with librarians providing these embedded services in courses, experiential learning programs, accelerators, incubators, and entrepreneurship centers. While, anecdotally, these research services are beneficial, it can be challenging to measure the impact of librarians’ efforts to support campus entrepreneurs. In order to assess this impact, this study sought to determine the effect of information literacy training (i.e., a research workshop and/or research consultations) on teams’ scores in the New Venture Competition, an annual campus-wide entrepreneurship competition at the University of California, Irvine (UCI).

Background

UCI and The New Venture Competition

Part of the 10-campus University of California (UC) system, UCI is a public, Carnegie R1 institution with over 37,000 students located in Orange County, California (University of California, Irvine, n.d.). The New Venture Competition is an idea-based competition, hosted by UCI's Beall Center for Innovation and Entrepreneurship, that guides teams through the entire startup process, including how to: ideate, form a team, go to market, and build a pitch deck. Although UCI's Beall Center for Innovation and Entrepreneurship is part of the Paul Merage School of Business, the competition is open to all majors and disciplines. In addition, while teams must be composed of at least two UCI students, anyone is eligible to participate, including faculty, staff, alumni, and members of the community. The interdisciplinary nature of the competition, and entrepreneurship in general, is evidenced by the competition's five tracks: Business Products and Services, Consumer Products, Consumer Services, Life Sciences, and Social Enterprise. Teams are provided with resources, mentors, and workshops throughout the months-long event, culminating with cash prizes awarded to the top teams in each track (UCI Paul Merage School of Business, n.d.)

The competition consists of three rounds: (1) the Concept Paper, (2) the Semi-Final Board Room Pitch, and (3) the Grand Finale Pitch. In the Concept Paper Round, teams submit a three-page paper about their idea, similar to an executive summary, which is scored by a group of judges according to a rubric. The highest scoring teams in each track advance to the Semi-Final Board Room Pitch Round, in which they prepare and present a pitch deck to a panel of judges, followed by Q&A. The top two finalists from each track, who are guaranteed prize money, then advance to the Grand Finale Pitch Round, a "quick-pitch" event inspired by the popular reality television show *Shark Tank*, in which the judges award additional prize money to one overall winning team (UCI Paul Merage School of Business, n.d.)

Library Information Literacy Training

Beginning in the 2020 academic year, the UCI Libraries' Innovation and Entrepreneurship Librarian partnered with the New Venture Competition to provide research support and information

literacy training for teams participating in the competition. This partnership included a research workshop and individual team research consultations. The research workshop, titled “Is There a Market for Your Product?,” incorporated both information literacy concepts and demonstration of relevant library resources for conducting industry, market, and company research. Using a fictitious new venture idea, the workshop walked teams through navigating databases such as IBISWorld, Mintel, and Mergent Intellect, to find industry outlook and market size information, identify and research competitors, and how to use these resources to strengthen competition deliverables. Since the competition involves multiple tracks, each with a unique focus, it was not possible to cover every available resource that may be relevant for all teams’ research. Thus, the research workshop provided a general introduction and overview of research strategies and resources, while encouraging teams to take advantage of individual team research consultations for personalized support.

Research consultations for the competition consisted of both in-person or virtual meetings, and email reference transactions. These services were promoted on the competition’s website, during the competition’s various workshops, and on the UCI Libraries’ Entrepreneurship Research Guide (<https://guides.lib.uci.edu/entrepreneurship>), which features a button for scheduling a consultation with the librarian. In all cases, these interactions were initiated by the teams, with some participating in multiple research consultations during the course of the competition. These consultations allowed teams to ask questions related to their specific idea and learn how to navigate specialized resources such as BCC Research or SimplyAnalytics, which could not be covered during the research workshop.

Literature Review

The last decade has seen a steady increase in professional librarianship literature focused on entrepreneurship. The majority of these articles take the form of case studies describing successful collaborations, partnerships, and outreach efforts, while also offering best practices for libraries and librarians seeking to engage with entrepreneurship groups at their university or in their community. These case studies show that libraries’ involvement with entrepreneurship can take many different forms. In

addition to the case study format, these articles also share common themes of embedded librarianship and the importance of information literacy when supporting the research needs of aspiring entrepreneurs.

One traditional form that libraries' involvement with entrepreneurship takes is course instruction, either as a one-shot session, or with librarians being embedded into the course. An example of librarians successfully being embedded into entrepreneurship-related courses is Kirkwood and Evans' (2012) case study describing their experience providing a series of instruction sessions and research consultations for students in both an introductory entrepreneurship course and a marketing course taught by the same professor. Similarly, Campbell and Cook (2010) collaborated with entrepreneurship faculty to embed information literacy instruction into a course featuring a market analysis project. According to the authors, students "did not understand that business research was conducted differently than other scholarly research" and "with the librarian's help, [students] spend their energy on the analysis, rather than on finding the data" (Campbell & Clark, 2010, pp. 173, 176). Librarians' involvement in entrepreneurship-related course instruction is not limited to courses in the school of business. Carroll et al. (2019) from North Carolina State University have also studied the effectiveness of an information literacy training program integrated into an undergraduate biomedical engineering course focused on medical innovation and product design. In addition to curricular collaborations, experiential learning programs are another avenue for library involvement. For example, the business librarian at the University of Nevada-Las Vegas developed a co-curricular collaboration with faculty to provide research support for students participating in a statewide business plan competition (Griffis, 2014). An ideal match for librarians, "experiential learning is highly research oriented and intensive offering unique opportunities for librarians to collaborate with business school faculty on the development of information literacy skills of business students" (Griffis, 2014, p. 340). While outreach to faculty and both curricular and co-curricular collaborations are common, much of the entrepreneurial activity at universities takes place outside the classroom, providing additional opportunities for librarians to share resources and services.

There are many examples of academic libraries collaborating with campus entrepreneurship centers, accelerators, incubators, and competitions to provide research support. A case study by Klotzbach-Russell et al. (2021) describes a cross-disciplinary effort to provide a series of information literacy workshops for entrepreneurs on topics including data visualization, market research, and patents and standards by partnering with the University at Buffalo's Blackstone LaunchPad. Embedding these sessions in the LaunchPad "allowed [the librarians] to connect with students [they] might not have otherwise encountered, as some admitted that they had not thought of contacting the library for help in relationship to entrepreneurship" (Klotzbach-Russell et al., 2021, p. 12). Taking the idea of embedding librarians in entrepreneurial centers a step further, Fitzgerald et al. (2010) from the University of Toronto Libraries partnered with the MaRS Discovery District, "a hub for entrepreneurial activity in Canada," to provide research services (p. 188). A new librarian position was created to serve as an on-site, librarian-in-residence at the MaRS Discovery District to help entrepreneurs conducting secondary market research (Fitzgerald et al., 2010). Hoppenfeld and Malafi (2015) also cite several examples of academic librarians collaborating with campus entrepreneurship entities in their case study. This included a business librarian at the University of Connecticut providing virtual consultation sessions for clients of the Connecticut Center for Entrepreneurship and Innovation and its incubator, and a librarian's support for Startup Aggieland, a campus incubator designed by students at Texas A&M University, which included providing instruction, creating a LibGuide, and purchasing books that can be borrowed from the incubator (Hoppenfeld & Malafi, 2015). In addition to partnering with entrepreneurial centers, librarians have also provided research support to campus entrepreneurship competitions. At Texas A&M University, engineering librarians provided point-of-need reference during Aggies Invent, a two-day student design competition hosted by the College of Engineering's makerspace (Stephens et al., 2021). Noting that these competitions usually take place outside the library, the authors encourage librarians to "be proactive and persistent in identifying and developing relationships with faculty and staff who organize and support enrichment programs or makerspaces" (Stephens et al., 2021, p. 355). These partnerships are often mutually beneficial, with librarians increasing the awareness and use of library resources and services by

local entrepreneurs, and entrepreneurship centers meeting a critical need for specialized research support for the entrepreneurs they serve.

Collaborations involving entrepreneurship also extend beyond the university campus to include community entrepreneurship organizations. Feldmann's (2014) study of academic business librarians that have partnerships outside the university found that these can include groups such as "Small Business Development Centers (SBDCs), chambers of commerce, and economic development offices" (p. 113). Notably, the majority of librarians involved in the study reported that it is challenging to measure or assess the impact of the library services provided to these groups (Feldmann, 2014). Griffis (2015) also cultivated a successful partnership with the Nevada Small Business Development Center (NSBDC), providing "presentations to classes on business research for developing business plans," as well as conducting "train-the-trainer" sessions with NSBDC staff in order to help them more effectively support clients' research needs (p. 464). Another example of academic librarians partnering with community organizations supporting entrepreneurs is the University of Toledo (UT) Libraries' collaboration with the Regional Growth Partnership, an economic development organization in Ohio, to develop the Launch Business Development Library (Martin, 2010). Regional Growth Partnership sought the expertise of UT's business and economics librarian to curate a list of books and databases "to help inventors successfully transfer new technology from a university lab or home garage to a small business venture" (Martin, 2010, p. 239). These examples illustrate that the value and relevance of academic libraries and librarians is wide-ranging and highly sought after among community entrepreneurship organizations.

The aforementioned research provides useful examples of libraries and librarians working with entrepreneurship-related groups, along with qualitative evidence of the success of these collaborations. While partnerships between libraries and the entrepreneurship community have been well-studied, there is a lack of quantitative research demonstrating the value of the research and information literacy services provided by the library. Building on the existing research, this study sought to measure the impact of library information literacy training on teams' performance in an entrepreneurial competition through quantitative analysis of teams' scores.

Hypotheses

In order to assess the impact of library information literacy training on teams' performance, the following competition scores formed the basis of the study's analysis:

- **Concept Paper Score(s):** Concept Papers are evaluated using a standard 6-question judging rubric (see Appendix) that uses a scale of 1 to 5 to assess how well teams described or defined the pain point, value proposition, target market, competitive advantage, and revenue model for their idea. Each Concept Paper is reviewed and scored individually by a group of judges (usually three to five), with teams receiving an overall score (out of a possible 30 points) based on an average of the judges' individual scores. As each rubric question has a connection to research and information literacy, teams' *Concept Paper scores* were used as one basis for the study's analysis.
- **Evidence Question Score(s):** The final Concept Paper rubric question asks: "Is there enough evidence to make the above believable?" As *evidence*, in this context, could refer to research or supporting information, this question has the most concrete connection to research and information literacy instruction. Thus, teams' *evidence question scores* (out of a possible 5 points), based on an average of the judges' individual scores for this specific rubric question, were also analyzed individually.

The study sought to investigate whether information literacy training and librarian research support had a positive effect on teams' performance in the New Venture Competition by testing the following hypotheses:

H₁: Teams who received information literacy training, via a research workshop, earned higher *Concept Paper scores* than teams who did not receive information literacy training.

H₂: Teams who received information literacy training, via a research workshop, earned higher *evidence question scores* than teams who did not receive information literacy training.

H₃: Teams who received additional information literacy training, via a research consultation, earned higher *Concept Paper scores* than teams who did not participate in a research consultation in the same competition year.

H₄: Teams who received additional information literacy training, via a research consultation, earned higher *evidence question scores* than teams who did not participate in a research consultation in the same competition year.

Methods

To test the study's hypotheses, three years of Concept Paper Round scores were analyzed to determine the impact of information literacy training on teams' performance in UCI's New Venture Competition.

Sample

The study uses a convenience sample of teams' *Concept Paper scores* from the 2019 (n = 106), 2020 (n = 75), and 2021 (n = 85) UCI New Venture Competitions. The competition encourages participants to build a diverse team of individuals with different backgrounds and skill sets, and this, along with its inclusive participation rules, is reflected in the varied makeup of the teams. While many business students naturally participate in the competition each year, engineering, medicine, and information and computer science are also heavily represented disciplines. In addition, the level of education and experience possessed by participants also varies greatly. Teams are composed of undergraduate students, graduate students, faculty, staff, alumni, and members of the community.

Treatment

Teams' scores from the 2019 competition, the year prior to the partnership between the competition and the library, were used as a control group. While it is possible that teams utilized library resources or sought help from a librarian during the course of the 2019 competition, there was no formal partnership in place and a research workshop was not provided. Teams' scores from the 2020 and 2021 competitions were used as experimental groups, with the difference being the mode of the instruction and reference services provided. In 2020, the research workshop and all research consultations were provided in-person (aside from email reference), while in 2021, the research workshop and all research consultations were provided virtually, due to the COVID-19 pandemic. The research workshop, described previously, was an hour-long optional session that included time for audience Q&A. Workshop

registrations were consistent for both years, with approximately 85 individuals registering to attend 2020's in-person workshop and approximately 90 individuals registering to attend 2021's virtual workshop. While exact attendance numbers were not available to the author, "live" attendance rates for both workshops are estimated to have been around 50%. In both cases, the session was recorded and made available on the competition's website for those who were unable to attend live. Unfortunately, the author did not have access to statistics regarding these recordings (e.g., total views or duration of views) as they were hosted by entities outside the UCI Libraries. Therefore, since the opportunity to consume the research workshop was available to all teams, either synchronously or asynchronously, all teams participating in the 2020 and 2021 competitions are considered to have *received information literacy training* for the purposes of investigating H₁ and H₂.

Participating in one or more research consultations was also an optional service provided by the Innovation and Entrepreneurship Librarian for teams seeking individualized research support. While email reference was also available, most teams that sought help booked 45-minute in-person or virtual (Zoom) appointments with the librarian, which were attended by one or more team members. As part of the appointment booking process, teams were asked to provide preliminary information about their topic (i.e., their venture idea), as well as their team name. This procedure allowed the librarian to identify teams who did and did not participate in a research consultation in order to investigate H₃ and H₄. The number of teams participating in research consultations increased from 14 (out of 75) teams in 2020 to 23 (out of 85) teams in 2021.

Data & Analysis

The decision to use scores from the Concept Paper Round as the units of analysis, rather than scores from the Semi-Final Board Room Pitch Round or the Grand Finale Pitch Round, was based on multiple factors. First, scores from this round constituted the largest sample size as approximately half of the teams are eliminated after the Concept Paper Round. Second, for consistency, the same judging rubric was used in the Concept Paper Round for each of the competition's five tracks, while the Semi-Final Board Room Pitch and Grand Finale Pitch Rounds use different rubrics for certain tracks, (e.g., Life

Sciences). Third, the Concept Paper Round is judged solely on teams' written, research-based, submissions, offering a more appropriate basis for the study's analysis, compared to the Semi-Final Board Room Pitch and Grand Finale Pitch Rounds, in which teams are evaluated on their pitch, as well as their presentation skills and ability to answer the judges' questions.

To test the hypotheses presented above, the study examines the differences in *Concept Paper scores* between the three years (2019, 2020, and 2021), as well as the difference in *evidence question scores*. In addition, the study further analyzes the two experimental groups (2020 and 2021) by examining the differences in scores between teams who participated in a research consultation and teams who did not participate in a research consultation during the same competition year. This included examining the difference in teams' *Concept Paper scores* and the difference in teams' *evidence question scores* for each of the two experimental groups (2020 and 2021). As this study involved analyzing existing data (competition scores) that were originally collected for non-research purposes, the study's protocol was reviewed by UCI's Institutional Review Board (IRB) and determined to be exempt [IRB#1136].

Results

SPSS statistical software was used to calculate average scores and perform statistical tests to check for significance among differences in scores between years, as well as between teams who participated in research consultations and teams that did not in the same year. An alpha of 0.05 was used for all tests of statistical significance.

Average *Concept Paper scores* (out of a possible 30 points) for each group are reported in Table 1, along with sample size and standard deviation. After confirming that the samples had equal variances using Levene's test for homogeneity ($p = .174$), a one-way analysis of variance (ANOVA) revealed that there was a statistically significant difference in average *Concept Paper score* between the three years ($F(2, 263) = 18.23, p < .001$). A subsequent Tukey-Kramer test for multiple comparisons found that the average *Concept Paper score* was significantly higher in 2020 compared to 2019 ($p < .001$, 95% CI [1.96, 4.69]), as well as in 2021 compared to 2019 ($p < .001$, 95% CI [1.03, 3.67]). There was no statistically

significant difference in average *Concept Paper score* for years 2020 and 2021 ($p = .245$, 95% CI [-0.46, 2.42]).

Table 1

Average Concept Paper Score

| Competition year | Sample size (teams) | Average Concept Paper score | Standard deviation |
|---------------------------------|---------------------|-----------------------------|--------------------|
| 2019 (control) | 106 | 18.18 | 3.76 |
| 2020 (experimental - in-person) | 75 | 21.50 | 4.60 |
| 2021 (experimental - virtual) | 85 | 20.52 | 3.17 |

Average *evidence question scores* (out of a possible 5 points), as well as sample size and standard deviation, are reported in Table 2. Using a Kruskal-Wallis test, an alternative to one-way ANOVA when sample variances are not equal ($p = .045$), a statistically significant difference in average *evidence question score* was found between the three years ($H(2) = 31.57$, $p < .001$). A post-hoc Dunn's pairwise comparison test using Bonferroni correction found that the average *evidence question score* was significantly higher in 2020 compared to 2019 ($p < .001$), as well as in 2021 compared to 2019 ($p < .001$). There was no statistically significant difference in the average *evidence question score* for years 2020 and 2021 ($p = 0.38$).

Table 2*Average Evidence Question Score*

| Competition year | Sample size (teams) | Average evidence question score | Standard deviation |
|---------------------------------|---------------------|---------------------------------|--------------------|
| 2019 (control) | 106 | 2.88 | 0.75 |
| 2020 (experimental - in-person) | 75 | 3.52 | 0.97 |
| 2021 (experimental - virtual) | 85 | 3.28 | 0.65 |

In addition to examining differences between the control (2019) and experimental groups (2020 and 2021), the study also analyzed the differences in scores between teams who participated in a research consultation and those that did not within each experimental group (2020 and 2021). Table 3 reports the average *Concept Paper scores* (out of a possible 30 points), while Table 4 reports the average *evidence question scores* (out of a possible 5 points), with sample sizes and standard deviations for teams who did and did not participate in a research consultation during the course of the 2020 competition.

Table 3*Average Concept Paper Score for Teams Who Did and Did Not Participate in a Research Consultation in 2020*

| Participated in research consultation (Yes/No) | Sample size (teams) | Average Concept Paper score | Standard deviation |
|--|---------------------|-----------------------------|--------------------|
| Yes | 14 | 22.81 | 2.62 |
| No | 61 | 21.20 | 4.91 |

Table 4

Average Evidence Question Score for Teams Who Did and Did Not Participate in a Research Consultation in 2020

| Participated in research consultation (Yes/No) | Sample size (teams) | Average evidence question score | Standard deviation |
|--|---------------------|---------------------------------|--------------------|
| Yes | 14 | 3.82 | 0.54 |
| No | 61 | 3.45 | 1.04 |

An unpaired Welch's t-test found that, in 2020, there was no statistically significant difference in average *Concept Paper score* for teams who participated in a research consultation ($M = 22.81$, $SD = 2.62$) and teams who did not participate in a research consultation ($M = 21.20$, $SD = 4.91$); $t(37.25) = 1.71$, $p = .096$. Further, Cohen's effect size value ($d = 0.35$, 95% CI [-0.23, .93]) suggests low to moderate practical significance. A similar result was found when comparing average *evidence question scores*. An unpaired Welch's t-test found no statistically significant difference in average scores for teams who participated in a research consultation ($M = 3.82$, $SD = 0.54$) and teams who did not participate in a research consultation ($M = 3.45$, $SD = 1.04$); $t(38.03) = 1.86$, $p = .071$. Further, Cohen's effect size value ($d = 0.38$, 95% CI [-0.21, 0.96]) suggests low to moderate practical significance.

Table 5 reports average *Concept Paper scores* (out of a possible 30 points), while Table 6 reports average *evidence question scores* (out of a possible 5 points), with sample sizes and standard deviations for teams who did and did not participate in a research consultation during the course of the 2021 competition.

Table 5

Average Concept Paper Score for Teams Who Did and Did Not Participate in a Research Consultation in 2021

| Participated in research consultation (Yes/No) | Sample size (teams) | Average Concept Paper score | Standard deviation |
|--|---------------------|-----------------------------|--------------------|
| Yes | 23 | 21.73 | 2.74 |
| No | 62 | 20.07 | 3.22 |

Table 6

Average Evidence Question Score for Teams Who Did and Did Not Participate in a Research Consultation in 2021

| Participated in research consultation (Yes/No) | Sample size (teams) | Average evidence question score | Standard deviation |
|--|---------------------|---------------------------------|--------------------|
| Yes | 23 | 3.58 | 0.57 |
| No | 62 | 3.16 | 0.65 |

Repeating these tests for 2021 produced contrasting results. An unpaired Welch's t-test found that, in 2021, the average *Concept Paper score* for teams who participated in a research consultation ($M = 21.73$, $SD = 2.74$) was significantly higher than the average *Concept Paper score* for teams who did not participate in a research consultation ($M = 20.07$, $SD = 3.22$); $t(45.93) = 2.36$, $p = .023$. A subsequent Cohen's d test of effect size suggests moderate practical significance ($d = 0.54$, 95% CI [0.05, 1.02]). Similarly, an unpaired Welch's t-test found that, in 2021, the average *evidence question score* was also significantly higher for teams who participated in a research consultation ($M = 3.58$, $SD = 0.57$) than for teams who did not participate in a research consultation ($M = 3.16$, $SD = 0.65$); $t(44.62) = 2.84$, $p = .007$.

A subsequent Cohen's d test of effect size suggests moderate to high practical significance ($d = 0.65$, 95% CI [0.16, 1.14]).

Discussion

The results of the study demonstrate a positive correlation between information literacy training and entrepreneurship competition scores. The statistically significant increase in average *Concept Paper score* for both experimental groups as compared to the control group indicates that the interventions (i.e., a research workshop and/or research consultations), had a positive impact on teams' performance. The statistically significant increase in average *evidence question score* for both experimental groups compared to the control group is also noteworthy, as this rubric question most closely aligns with research and the goals of information literacy instruction. This result suggests an increase in both the number and quality of sources used by teams to support claims made in their Concept Papers, likely due to their awareness and use of library resources. Interestingly, the lack of a statistically significant difference in either score between the two experimental groups suggests that the mode of instruction and reference services provided, in-person or virtual, did not have a meaningful impact on teams' performance.

These findings also support the previous literature, indicating that embedded librarianship, regardless of the mode, is effective in improving the research-related outcomes of entrepreneurial activities. Whether information literacy instruction and reference services are delivered in-person, as with the 2020 New Venture Competition, or delivered virtually, as with the 2021 competition, partnering with this type of co-curricular entrepreneurship competition proved to be mutually beneficial. Integrating the research workshop into the competition's slate of other workshops to help participants prepare their Concept Papers, as well as advertising research consultations on the competition's website, signaled the value and relevance of library resources and services to participants. The success of both modes of embedded librarianship also has positive implications for librarians interested in similar collaborations with entrepreneurial activities on their campus or in their community. As limited time and resources are always a factor in such outreach efforts, the option to participate in such collaborations remotely, yet achieve similar outcomes, is notable.

The analysis of scores for teams who did and did not participate in a research consultation within each experimental group produced differing results. While both the average *Concept Paper score* and average *evidence question score* for teams who participated in a research consultation in 2020 were higher than those for teams who did not participate in a research consultation, the difference was not found to be statistically significant in either case. However, the opposite was found when analyzing scores from 2021. In this experimental group, average *Concept Paper score* and average *evidence question score* were found to be statistically significantly higher for teams who participated in a research consultation than for teams who did not. The lack of statistical significance in the difference in scores for teams who did and did not participate in a research consultation in 2020 is surprising, as it does not align with the rest of the results from the study. One could speculate that the law of diminishing returns may apply in this case. For example, the benefit derived from individual research consultations, in which teams receive additional information literacy training, is less than that which is derived from a research workshop. Nonetheless, the findings of the study align with the literature regarding the value of information literacy in entrepreneurship research.

Limitations

While tests of statistical significance indicate that there is a positive relationship between information literacy training and entrepreneurship competition scores, it is difficult to establish causality. As with most studies, there are additional factors that may influence the differences in average scores between the various groups analyzed. For example, the diversity of competition participants (e.g., undergraduate students, graduate students, faculty, staff, alumni, and community members) leads to varying levels of education, entrepreneurial and research experience, and access to library resources. Teams who do not place in the competition are also encouraged to return and compete again the following year with the same idea (competition rules state that ideas may not be in existence for more than two years). This prior experience means that some teams may benefit from judges' feedback received the previous year. In addition, while the Concept Paper judging rubric remained consistent across the three years studied, the judges involved in the competition likely varied from year to year due to their

availability, leading to potential variability in scoring. Judges' opinions as to the novelty and/or value of the product or service being proposed are also likely to change over time, impacting their scoring habits.

Given the timeframe of this research, the COVID-19 pandemic also posed an unavoidable limitation on this study. While the difference in learning environment between the two experimental groups due to the pandemic (in-person versus virtual) is known, inevitably, the widespread impact of the pandemic resulted in additional differences in scores between the two years. In addition to potential sources of differences in average scores between the various groups analyzed, the lack of access by the author to certain data, such as exact workshop attendance numbers and recording views, was another limitation that effected the study's design. With regards to the generalizability of the study's results, the use of a convenience sample of scores from one institution's entrepreneurship competition can also be considered a real-world limitation.

Conclusion

This quantitative study adds to the growing body of case studies describing successful collaborations, partnerships, and outreach efforts between libraries and entrepreneurship groups in both university and community settings. While the findings—that embedded research support and information literacy training has a positive impact on entrepreneurship competition scores—is perhaps not surprising, it offers measurable evidence of the benefits of partnerships between academic librarians and campus entrepreneurship activities. As one of the first quantitative studies in this area, it will be interesting to see if the results are replicated by similar studies in the future. Aside from studies seeking to validate the findings of this study, future research could employ a mixed-methods approach, incorporating qualitative feedback from teams regarding the research services they receive. Supplementing score data with information about which library resources teams used and how they incorporated research into competition deliverables could, perhaps, provide a more holistic view of the role and value of research in the entrepreneurial process and provide librarians with additional insights.

The results of this study are of value to both librarians and entrepreneurship educators. Librarians can use the findings as evidence of the positive impact research and information literacy training has on

new venture development when attempting to initiate a partnership or collaboration with a campus or community entrepreneurship organization. Entrepreneurship educators can also use this research as motivation to enhance existing entrepreneurship competitions and organizations by incorporating research and information literacy training, provided by the library.

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Appendix

UCI New Venture Competition Concept Paper Judging Rubric 2019-2021

| | 5 Points | 4 Points | 3 Points | 2 Points | 1 Point | Judges' Comments |
|--|--|---|---|---|---|--|
| | Wow Factor | Shows Merit | Mediocre, Not Remarkable | Below Average | Did Not Follow Guidelines | Please explain your reasons for the given score. |
| Has the pain been clearly described? | The pain point has been fully and clearly addressed. It shows significant value. | The pain point was described but could use some clarification. | The pain point was described but it was a mediocre explanation that possesses moderate value. | The pain point was incomplete and the explanation was below average and demonstrates little to no value. | The pain point was not mentioned. | |
| Has the value proposition been clearly defined as it relates specifically to the pain point? | The value proposition has been fully and clearly addressed. It shows significant value. | The value proposition was described and it was above average, but it could use some clarification. | The value proposition was described but it was a mediocre explanation that possesses moderate value. | The value proposition was incomplete and the explanation was below average and demonstrates little to no value. | The value proposition was not mentioned. | |
| Is there a clearly defined target customer or market segment linked to the described pain? | The target customer or market segment has been fully and clearly identified, and it is linked to the described pain. | The target customer and/or market segment was described and was above average, but it could use some clarification. | The target customer and /or market segment was described but it was a mediocre explanation that possesses moderate value. | The target customer / market segment was incomplete and the explanation was below average and shows little to no value. | The target customer / market segment was not mentioned. | |
| Is there a clearly demonstrated sustainable competitive advantage for the company? | There is a clear sustainable competitive advantage. | The competitive advantage is described but would use clarification. | The competitive advantage is described, but it was a mediocre explanation that possesses moderate value. | The competitive advantage described was incomplete and shows little to no value. | There is no explanation on the competitive advantage for the company. | |
| Has it been clearly explained how the venture will make money? | It is very clear how the venture will make money. | It is described how the venture will make money, but could use clarification. | It is described how the venture will make money, but it was mediocre and shows moderate value. | The description on how the venture will make money was incomplete and was below average. | There is no explanation on how the venture will make money. | |
| Is there enough evidence to make the above believable? | Yes, there clear evidence to make 1-5 believable. | The evidence described was above average, but it could use some clarification. | The evidence described was mediocre and shows moderate value. | The evidence described was incomplete and was below average. | The evidence was not mentioned. | |

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