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- I-Corps Sites, located at several universities, offer shortened curricula to qualify teams for participation in the national I-Corps program (NSF I-Corps Teams).
- The core topics covered in I-Corps Sites' curricula teach teams about the importance of customer discovery; the teams are expected to leave the lab and personally interview 20+ potential customers to determine their product-market fit.

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I-Corps as a Training Tool for New Technology Development

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Topic Relevance by Timeline

Summary

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Introduction

The National Science Foundation (NSF) funds approximately \$7 billion worth of research spanning various fields of science and engineering every year. However, many startups emerging from academic-funded research fail due to lack of demand for the product or service they develop. While the technology can be innovative, these startups fail because they lack customers or their product or service does not address a customer need. In 2011, the NSF started Innovation Corps (I-Corps) to address the challenges faced by these early-stage companies as well as to develop and grow a national innovation ecosystem. The I-Corps curriculum was built on an accelerated version of Stanford University's Lean LaunchPad course and personalized for the unique audience of university scientists ("I-CorpsTM Curriculum and Resources"). The I-Corps concept has grown and now receives support from multiple federal agencies, including the National Institutes of Health and the Centers for Disease

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Control and Prevention. I-Corps serves as a training program that aims to facilitate the translation of technology from university research into the marketplace for the benefit of society (*I-Corps Teams Webinar - April 11, 2017*).

I-Corps Overview

I-Corps is a program that guides the development of scientific research and discoveries into technologies, products, and services that benefit society. The program is aimed at teams comprised of university scientists and students, and it prepares them to move beyond the university laboratory and to commercialize their research projects (see the chapter “Intellectual Property: Commercializing in a University Setting”). Participants learn entrepreneurial skills that enable them to discover the commercial potential of their innovations (“NSF Innovation Corps (I-Corps™)”).

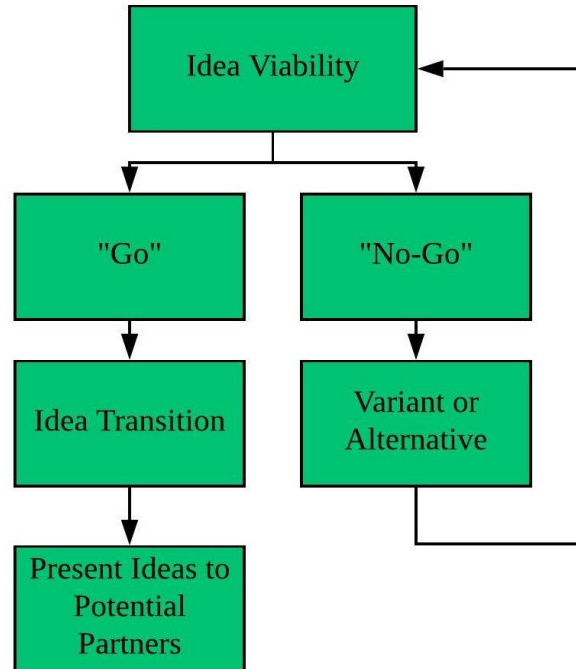
By providing teams with resources and guidance on translating their research into commercial technology, I-Corps enables participants to fulfill three main objectives. First, following the completion of the program, teams definitively conclude whether they will go forward with their idea. Based on the lessons learned in the program, teams decide if their innovation has the potential to become a commercially viable product. If their idea is a go, the team decides to move forward with commercializing their project. If the team decides it is a no-go because it lacks market potential, they pivot to a variant or alternative. Second, teams that decide to move forward develop a plan for transitioning their idea from a laboratory-based innovation to a marketable product or service that has the potential to impact society. Third, teams build an understanding of how to present their ideas to potential partners in order to further develop their technology into a business (“Innovation Corps - National Innovation Network Teams Program (I-Corps™ Teams)”).

The NSF provides a national network to foster collaboration and promote coordination between three I-Corps components: Teams, Sites, and Nodes (see Figure 2). I-Corps Teams is a nationwide program that trains and funds NSF and other researchers and their teams to transition their research into the marketplace. In addition to the national I-Corps Teams component, there are 8 regional Nodes and 86 active Sites throughout the United States. I-Corps Nodes support specific geographic regions, provide regional training, and are responsible for identifying effective entrepreneurial content for their regional curricula. In the long term, I-Corps Nodes seek to determine how academic institutions can increase their support for entrepreneurial efforts. I-Corps Sites are based at individual academic institutions that have pre-existing innovation or entrepreneurial programs. Each I-Corps Site provides support for several local teams to commercialize their technology through shortened training programs (“Directory of I-Corps™ Nodes and Sites - VentureWell”).

The first step is to participate in a site I-Corps program. For example, the University of Pennsylvania runs an I-Corps Site that offers short courses that cover some aspects of the national curriculum. Based in the Penn Center for Innovation, Penn I-Corps is a three-week course for two- to four-person teams

who are affiliated with Penn. Penn I-Corps begins with an in-person opening workshop, followed by an interviewing workshop and a midpoint review, and concludes with a closing workshop. Unlike national program participants, local Site teams are not required to have NSF funding history to be eligible; however, participation in Penn I-Corps qualifies teams to apply to the national program. Similarly to the national program, Penn I-Corps provides an opportunity for teams to interact with instructors, gain experience conducting in-person interviews, and present what they learn. Specific topics covered in the Penn I-Corps curriculum are discussed in the next section, Local I-Corps Key Topics. Penn I-Corps teams have the same member composition as national teams except that I-Corps mentors are not required. Penn I-Corps can provide teams with up to \$3,000 in funding for customer discovery, and teams are required to interview 20 potential customers by the completion of this program (“Penn I-Corps Site - Penn Center for Innovation”).

Figure 1. Main Objectives in I-Corps.



Once a team has completed a site program, they are eligible to apply for the national program. The I-Corps Teams curriculum consists of a seven-week interactive and immersive learning experience. During the first week of the program, a cohort of approximately 20 teams participate in the curriculum together and travel to a 3-day kickoff event at the cohort location. The kickoff event provides an introduction to the program and is the first opportunity for teams to interact with the program instructors. Customer discovery is fundamental to the I-Corps program, and teams begin their customer interviews during the kickoff event (see the chapters “Identifying Unmet Needs: Problems That Need Solutions” and “Design Theory: Understanding Customer Needs Through Discovery and Interviewing”). For the

following four weeks, teams participate in weekly online webinars while conducting in-person customer interviews. Teams are expected to conduct at least 100 interviews with potential customers. As part of the national program, each team receives a \$50,000 grant to fund the customer discovery process, which allows them to gather feedback from potential commercial customers and partners. Each week the webinars train teams on new topics that are part of the I-Corps curriculum. During the sixth week, teams share how they have adapted their business model to accommodate the information learned through the webinar lessons and customer interviews. During the seventh and final week, teams travel back to the cohort location for a two-day “lessons learned” event. Here teams share their key takeaways from the previous six weeks and their resulting updated business models. Teams also reach a go or no-go determination, which explains their decision to pursue or not to pursue their idea beyond the I-Corps program. Teams that decide to continue with their idea are provided with guidance for applying for funding through a Small Business Innovation Research (SBIR) grant, Small Business Technology Transfer (STTR) grant, or other NSF grants (*I-Corps Teams Webinar - April 11, 2017*) (see the chapter on “SBIR/STTR Grants: Introduction and Overview”).

Table 1. Features of the National I-Corps Teams Program and a Sample Local I-Corps Program.

<u>Features</u>	<u>National I-Corps</u>	<u>Sample Local I-Corps</u>
Duration	7 weeks	2-5 weeks
Customer Discovery Grant	\$50,000	\$3,000
Team Size	3	2 - 4
Team Members	EL, TL, and IM	EL and TL (IM optional)
University Affiliation	Any	Yes
Required Interviews	100	20
Prerequisites	NSF Funding or Participation in Local I-Corps Program	None

I-Corps Teams consist of three primary members: the entrepreneurial lead, the technical lead, and the I-Corps mentor. The entrepreneurial lead (EL) is a postdoctoral research fellow, graduate student, or other scientist or engineer with knowledge of the technology. The entrepreneurial lead should be capable of supporting the transition of the innovation to market and should seek to play a role in the startup that may emerge from the technology. The principal investigator or technical lead (TL) is a researcher with deep technical experience in the subject area of the technology who typically has NSF

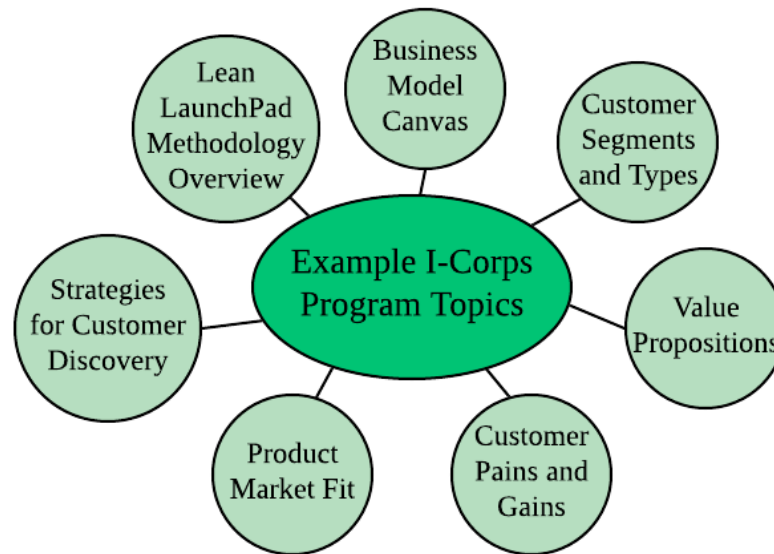
funding history. They are usually a faculty member but may also be a postdoctoral research fellow or research scientist. However, a technical lead without NSF funding history may be considered for the national program if they successfully completed a local or regional I-Corps program. The I-Corps mentor (IM) is typically a current or former entrepreneur with relevant industry experience, preferably in the same geographical area as the remaining team members. The I-Corps mentor is someone not directly involved with the research and is charged with encouraging the intellectual focus of the team and assisting in navigating the industry by providing initial customer contacts (*I-Corps Teams Webinar - April 11, 2017*).

The application process for the national I-Corps Teams program is simple and quick. Eligible teams submit a two-page executive summary. It includes a description of the team, an explanation of their NSF funding eligibility or regional program participation, a description of the technology, the potential commercial impact or application of this technology, and their current commercial plan. Teams are evaluated on a rolling basis, and a successful submission results in a first-round interview with NSF staff. Successful teams are selected for a second-round interview with I-Corps instructors. Finally, teams selected by the I-Corps instructors are asked to submit a formal proposal and select a cohort to join (*I-Corps Teams Webinar - April 11, 2017*). Table 1 compares and contrasts some of the key characteristics of the national I-Corps Teams program and a sample local I-Corps at the University of Pennsylvania.

Local I-Corps Key Topics

Local I-Corps curricula cover several core topics that are essential to the successful commercialization of technology. For example, the topics discussed in the Penn I-Corps program include the following: an overview of the Lean LaunchPad methodology, the business model canvas, customer segments and types, value propositions, customer pains and gains, product market fit, and strategies for customer discovery. Through these core topics, teams learn key lessons that play an important role in helping them successfully develop their potential startup.

One of the first topics that Penn I-Corps teams are introduced to is the idea of the Lean LaunchPad, a method first coined by entrepreneur Steve Blank. The goal of this method is to adapt to the ever-shifting market in order to avoid creating a product or service that no one will be interested in purchasing (Blank). The Lean LaunchPad model enables entrepreneurs to discover what customers care about instead of investing heavily in their initial idea without investigating customer input. The model promotes an iterative process that continually reshapes a business idea so that it can effectively identify and validate the customer's problems (Warner, *Intro To I-Corps and Business Model Generation*). I-Corps teams are taught that they will not know all the answers at the start and must begin by guessing. By interacting with customers, entrepreneurs build an understanding of their customers' problems and test the validity of their hypotheses. I-Corps teaches teams to use this iterative evidence-based model to develop effective hypotheses and pivot their project based on customer findings in order to create a product or service that fits the customers' needs.

Figure 2. Topics in an Example I-Corps Program.

Penn I-Corps teaches teams to replace business plans with business models based on the Business Model Canvas (Osterwalder), a framework that summarizes the key hypotheses of a lean startup. The Business Model Canvas is a diagram that links the values a company creates for itself and the values it brings to its customers, and it is typically presented as a one-page table. Penn I-Corps begins by focusing on the customer segment portion of the Business Model Canvas. The first step to understanding the customers and their problems is identifying exactly who the customers are (see the chapter “Identifying Unmet Needs: Problems that Need Solutions”). Teams learn to identify all their potential customers and categorize them based on market segments and customer types. Markets can be segmented based on demographic differences, such as age, gender, and location. Within each segment, customers are further divided into types, depending on the role they play with the product. Customer types include the decision maker, economic buyer, influencer, recommender, end user, and saboteur (Warner, *Customer Segments and Value Propositions*). By mapping out their customer ecosystems, teams are able to identify their most important customer type, who then serves as the target customer of their business. Identifying a target customer enables teams to shape their business to address the specific needs of these customers (in addition to the one-page Business Model Canvas, more complex business models are described in the chapter “Writing the Business Plan for a Life Science Startup”).

Another key topic crucial to a successful business is identifying clear value propositions. For example, Penn I-Corps instructors accentuate the fact that value propositions go beyond the features or benefits of a product. Value propositions link who the customer is and why they want to buy the product. In other words, a value proposition identifies how the product provides a gain or relieves a pain specific to the target customer, which explains why the customer will buy the product. Value propositions must be centered on the customer, communicate customer benefits, identify specific competitive

advantages, and be testable (Warner, *Intro To I-Corps and Business Model Generation*). By developing strong value propositions, teams ensure that customers want to buy their product, and thus their companies are able to differentiate their product from that of the competition.

I-Corps focuses on customer discovery by teaching teams to leave the laboratory setting and conduct in-person interviews with potential customers. Through these interviews, teams are able to validate or invalidate their business model hypotheses, understand their product market fit, and gain insight into their customers' needs and wants. Teams are warned not to fear picking the wrong market at the start because they can always pivot their strategy. I-Corps encourages teams to take initiative by cold-calling for interviews, as it is most important to speak with potential customers they do not know personally since they are more likely to provide truthful feedback (Isakowitz). Teams are taught several effective interview tactics needed to build relationships with potential customers. For example, when reaching out to interviewees it is important not to sell the product to the potential customer (Easley). Instead, teams are taught to find out what the customer wants, and from that gain insight into the market and shift their business accordingly. I-Corps instructors emphasize particularly the importance of open-ended questions that allow for more informative interviews (Isakowitz). In addition, it is important to ask for referrals in order to grow the customer network. By focusing on customer discovery, I-Corps teams can develop products that address the needs of their customers and develop their technology into successful businesses.

I-Corps Case Study

Many startups, such as NeuroFlow, emerged from teams participating in I-Corps. NeuroFlow is a software platform that aims to improve the mental health of patients. The platform relies on wearable devices to capture patients' biometric data such as heart rate variability (HRV) and electroencephalogram (EEG) in a real-life setting. This provides clinicians with objective measures that can be used to track the mental health progression of their patients (Forstat).

NeuroFlow was founded in 2016 by Chris Molaro and Adam Pardes. Currently, the company has seven full-time employees in addition to the two founders and serves 25 customers nationwide. Pardes began pursuing his PhD in bioengineering at the University of Pennsylvania, and is currently focusing his time on growing NeuroFlow. Molaro, a West Point graduate and Wharton MBA, has previous entrepreneurial experience through his nonprofit organization, Things We Read. The two founders, joined by Jacob Forstat, an orthopedic bioengineer, participated in both the local and national I-Corps programs. The local program was based at the Penn I-Corps Site, while the national program's kickoff event was held in Atlanta, Georgia. However, the team conducted their customer research activities in Philadelphia and participated in weekly webinars with the program leads (Forstat).

According to Forstat, participating in both the local and national I-Corps programs played an important role in helping the founders turn their innovative idea into a viable startup. Forstat said that one of the

most important lessons that his team learned from I-Corps was how to gain an understanding of their customers. In particular, Forstat emphasized the technique of repeatedly asking “why will the customer want to buy this?” This technique allowed the founders of NeuroFlow to understand what motivates their customers’ decisions and how their customers perceive value in a product (Forstat).

As a result of their I-Corps training, Forstat and his teammates made several key business decisions that enabled NeuroFlow to develop. Specifically, the selection of NeuroFlow’s entry target market was heavily influenced by I-Corps training in understanding customers and how to address their needs, as well as how to adjust the company’s marketing campaign to attract target customers to their product. I-Corps helped Neuroflow identify their target customers and become more directed in their marketing, and it provided the company with opportunities to connect with these customers. I-Corps training supported NeuroFlow’s growth from an idea into a revenue-generating business that has the potential to make a positive impact on society (Forstat).

Conclusion

As of February 2017, NSF I-Corps Teams has offered 43 courses that have trained 905 teams consisting of 2,908 individuals from 217 universities. Participants have emerged from the program with extremely positive reviews about their experience, and 89% remained active 13 to 21 months following completion. Of the participants, 97% said the course met or exceeded their expectations, and 98% reported it had a positive influence on their career and research. The program has led to the formation of 361 companies, of which 54% have developed collaborations with their industry, 28% with the government, and 26% with investors. Over \$100 million in funds have been raised to support this initiative. Through ongoing collaboration with the NSF, I-Corps continues to successfully transform financial resources invested in research into products and technologies with economic and social impacts (“NSF Innovation Corps (I-CorpsTM)”).

Resources

1. NSF Innovation Corps (I-CorpsTM)
 - a. This website, hosted by the NSF, gives an overview of I-Corps.
 - b. https://www.nsf.gov/news/special_reports/i-corps/
2. I-CorpsTM at NIH
 - a. This website, hosted by the National Institutes of Health (NIH), gives an overview of I-Corps funding from the NIH and the Centers for Disease Control (CDC).
 - b. <https://sbir.cancer.gov/icorps>
3. “Why the Lean Start-up Changes Everything”
 - a. This article by Steve Blank in the Harvard Business Review provides a good overview of the idea of a lean startup, which is at the core of the I-Corps methodology.
 - b. <http://hbr.org/2013/05/why-the-lean-start-up-changes-everything>

4. “Penn I-Corps Site - Penn Center for Innovation, University of Pennsylvania 2018,
 - a. This website provides information about the Penn I-Corps program, including application guidelines, program dates, eligibility.
 - b. <http://pci.upenn.edu/icorps/>

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