INNOVATION CORPS: A REVIEW OF A NEW NATIONAL SCIENCE FOUNDATION PROGRAM TO LEVERAGE RESEARCH INVESTMENTS

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Chairman Brooks, ranking member Lipinski, and other members of the subcommittee, thank you for the opportunity to discuss with you the National Science Foundation Innovation Corps.

My name is Steve Blank. I am a Consulting Associate Professor at Stanford University, and an Adjunct at U.C. Berkeley Haas Business School. I am the architect and author of the National Science Foundation Innovation Corps curriculum. In volunteering my services to the National Science Foundation my career has gone full circle. I started my government service with 4 years in the U.S. Air Force during Vietnam – serving a year and a half in Southeast Asia. I've spent the last 34 years in Silicon Valley, 21 years as an entrepreneur in 8 startups and the last 11 years as an educator teaching at Stanford, U.C. Berkeley and Columbia University.

I'm here today to offer my thoughts on the benefits of the NSF Innovation Corps (I-Corps) program to the U.S. taxpayer, share with you some of the results of the class and to describe my role in the program.

Summary

The National Science Foundation's funding of America's research universities "have been the critical assets that have laid the groundwork—through research and doctoral education—for the development of many of the competitive advantages that make possible the high American standard of living. Business and industry have largely dismantled the large corporate research laboratories that drove American industrial leadership in the 20th century (for example, Bell Labs), but have not yet fully partnered with research universities to fill the gap."[1]

Over the last three decades the SBIR/STTR programs were created to bridge this gap by increasing private-sector commercialization of proposed innovations derived from Federal research and development funding and stimulate technological innovation while meeting federal research and development needs.

Yet in the decades since the inception of the SBIR/STTR programs, there has not been a formal education process to help these federal research innovations transition from the university lab into a profitable company.

The NSF Innovation Corps is the first successful STEM education program to bridge the gap between NSF funded researchers who want to commercialize their technology and the

[1] http://www7.nationalacademies.org/ocga/testimony/Research_Universities.asp

needs of private capital. Data from the first 50 I-Corps teams confirm the effectiveness of the program. We believe the result will be new jobs and increased competitiveness of American industries.

There have been two other consequences of this program. The first has been the leveraging effect as Principal Investigators take what they learned from I-Corps back to their home institutions and develop workshops and similar opportunities on their own campuses. The second has been the applicability of the program to small business innovation and job creation on "Main Street" as well as in technology startups.

What's New About the I-Corps?

The I-Corps capitalizes on new insights we have about reducing the failure rate of new startups. We now know that *startups are not smaller versions of large companies*.

- Until now classes for entrepreneurship assumed that techniques learned in business school (i.e. how to write a business plan, 5-year forecasts) were applicable to new ventures. We now know that's wrong.
- We now know that new ventures are a series of untested hypotheses (guesses).
- While researchers believe that a company is just about their invention, the I-Corps program teaches them that *their technology idea alone is not a company*.
- A company is the sum of their technology idea *plus* customers, distribution channels, pricing, partners, etc.
- Therefore, a new startup requires deep understanding of all these other parts to be successful. (We call the sum of these parts of a company *a business model*.)
- The program emphasizes that this deep understanding can not be found inside research labs or libraries, but instead the researchers need to get out and talk to potential customers. (An average team meets at least 100 customers during the class.)
- The program teaches researchers a methodology called *Customer Development*, a process of rapidly and *inexpensive*ly testing their business hypotheses.
- Since hypotheses' testing is an integral part of the scientific method, scientists grasp this concept of testing business hypotheses immediately.

Companies have adopted the customer development process because it consumes less cash, wastes fewer resources and allows them to bring products to market rapidly.

I-Corps - A Uniquely American Program

One of the unique parts of the class is applying the scientific method to building startups. Teams start with a hypothesis – in this case about some part of their business (who are their customers, partners, etc.), they design experiments to test those guesses, get out of the lab and run the test. With the data in-hand they attempt to derive insight from the data and either verify or disprove the hypothesis.

But much like in science, in business most experiments fail. Teams pick the wrong customers, or the wrong pricing, or the wrong partners or even the wrong features for their product. But the customer development process says *failure is an integral part of the processes.* If you're hypotheses are incorrect you *pivot* – that is you make a substantive change a try something different.

By running the process of hypothesis testing and pivots at an extraordinary high rate of speed, startups rapidly converge on a potential solution to "how do I turn a technology into a company."

This process is uniquely American. At its heart *it embraces failure*. We don't punish it we don't give up when it happens we just simply recognize that Americans understand that failure is part of the startup (and science) culture. Careers don't end if experiment didn't work or your company fails – you do another one. This tolerance for risk in our society is what enables us to fund basic research. It's why Silicon Valley investors fund startups *when over 90% of startups fail.*

We have a special word for failed entrepreneurs in the U.S. that visitors to this country have a hard time understanding – *experienced.*

Why is this Program Necessary?

One would think that private investors would be flocking to advanced technology coming out of our universities. Yet the reality is that proposed technology innovations are just one part of what makes a fundable company. A *mistaken assumption is that it's the role of private capital to assess technology and determine whether there exists a viable fundable company*. In fact, *it's the role of the company to investigate the business opportunity* of the technology *and present it to potential investors*.

The job of the I-Corps program is to teach our top scientists how to develop the many other essential components that make up an investable business (customers, pricing, sales channel, partners, marketing, manufacturing, etc.) and present them to private capital in a form that that articulates how investors can make money. And to do so in weeks, not in years.

I-Corps is an *educational program* that is a bridge to private capital - *not a replacement* for private capital. Venture capitalists co-teach the class to prepare the teams so they can become fundable. Almost none of the entrants to the I-Corps cohorts could have attracted private capital. Upon graduation 92% of the I-Corps graduates stated they were going to go out and raise money – either from the NSF or with private capital - to build companies and put Americans to work. Given that most of them didn't know what a startup was coming in, this was a bit astonishing. Every new company that gets funded means new jobs are being created.

Picking Winners and Losers

The I-Corps program does not pick winners and losers. It doesn't replace private capital with government funds. Its goal is to *get research the country has already paid for to the point where a team can attract private capital in the shortest period of time*. (It's why we teach the class with experienced Venture Capitalists.) Every team has volunteered for the program. The marketplace, not the government, will decide whether their new venture will win or lose.[2]

[2] http://www.nsf.gov/news/newsmedia/i-corps/team_summaries.pdf

While many government agencies use the Technology Readiness Levels[3] to measure a project's *technical* maturity, there are no standards around *business* maturity levels. The output of the NSF I-Corps class provides a proxy for a minimum level of business maturity.

Our goal is get the science out of the labs and into use by U.S. corporations. For the first time, private capital now can look at "business ready" technology.

Why is a Federal Program Necessary?
The NSF I-Corps class has different goals then the same class taught in a university or incubator. In a university, the class teaches a methodology the students can use for the rest of their careers. In an incubator, the class develops angel or venture-funded startups.

When taught for the NSF I-Corps, the goal of the class is to teach NSF-funded researchers how to move their technologies from university labs into the commercial world. Unlike a traditional incubator where a successful outcome is an angel or venture-funded startup, for the I-Corps the expected outcomes for teams include:

New startups funded via:

- a NSF SBIR Phase I grant (over 25% of the teams apply)
- Angel/VC funding (over 90% of the teams will seek additional funding)
- Patent or technology license to a U.S. company

If the teams pursue a SBIR Phase I grant ($150K), the NSF looks at the I-Corps projects and asks: 1) is this teams product viable? Go/no go? 2) If it's a go, what's the transition plan to do so?, and 3) can this be a technology demonstration for potential partners?

Principal Investigators managing research at their university labs cannot take three months off to attend a class at Stanford without interrupting their teaching and research. Therefore the classes need to be offered at multiple sites in the U.S. with the majority of the coursework performed at the teams University. Only the Federal government can provide the funding and logistics for the hundreds of I-Corps teams seeking the opportunity to commercialize their research.

Innovation Corps Status

Beginning in 2011 we taught two I-Corps cohorts: 21 teams ending in December 2011 and 24 teams ending in May 2012. As we speak, in July 2012 we are teaching 54 more teams – 27 at Georgia Tech and 27 at the University of Michigan. We plan to educate another 50 teams in October. Each 3-person team consists of a *Principal Investigator, an Entrepreneurial Lead* and a *Mentor.*

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[3] http://www.hq.nasa.gov/office/codeq/trl/trl.pdf

The *Principal Investigator* (average age of ~45) is faculty member who runs his or her own research lab and has had an active NSF grant within the last 5 years. The Principal Investigator forms the team by selecting one of his graduate students to be the Entrepreneurial Lead.

The *Entrepreneurial Lead* is a graduate student or post doc (average age ~ 28) who works within the Principal Investigator's lab. If a commercial venture comes out of the I-Corps, it's more than likely that the Entrepreneurial Lead will take an active role in the new company. (Typically Principal Investigators stay in their academic role and continue as an advisor to the new venture.)

Mentors (average age ~50) are experienced entrepreneurs who are located near the academic institution and have experience in transiting technology out of academic labs. Mentors are recommended by the Principal Investigator (who has worked with them in the past) or they may be a member of the NSF I-Corps Mentor network. Some mentors may become an active participant in a startup that comes out of the class.

Teaching Objectives

Few of the Principal Investigators or Entrepreneurial Leads had business startup experience, and few of the mentors were familiar with either Business Model design or Customer Development.'

Therefore, the teaching objectives of the I-Corps class are:

1) Help each team understand that a successful company was more than just its technology/invention by introducing all the parts of a business model (customers, channel, get/keep/grow, revenue models, partners, resources, activities and costs.)
2) Get the teams out of the building to test their hypotheses with prospective customers. The teams in the first cohort averaged 80 customer meetings per team; the second cohort spoke to an average of 100.
3) Motivate the teams to pursue commercialization of their idea. The best indicators of their future success were whether they a) found a scalable business model, b) had an interest in starting a company, and c) would pursue additional funding.

My Role in the I-Corps Program

The I-Corps class was derived from my 21 years of startup experience. Those years gave me the freedom to give back to my country and community to teach entrepreneurship. It allowed me to explore a totally different way to think about and teach new venture formation. I'm proud that startups in Silicon Valley and other entrepreneurial clusters in the U.S. and the world have rapidly adopted the Lean Startup and Customer Development methods. But its embrace by our country's leading scientists that make me most proud. We've cracked the code on entrepreneurship. We now know how to make startups fail less.

Scaling the I-Corps Program

I taught the first two I-Corps classes alongside venture capitalists I asked to volunteer their services to the country. None of us received any compensation for our efforts.

Other regions in the U.S. around research universities have a robust entrepreneurial culture (what they lack is a robust venture capital culture.) The program was designed from inception to scale in those research universities with entrepreneurial curricula. It is built around a formal methodology of business model design and customer development. The rigor of the framework allows entrepreneurship faculty in other universities to come up to speed quickly. In fact, in March we trained the first set of instructors from other universities. As we speak, the I-Corps is being taught simultaneously in Georgia Tech and the University of Michigan. And the NSF will be announcing its plans to scale it further to other universities.

Results

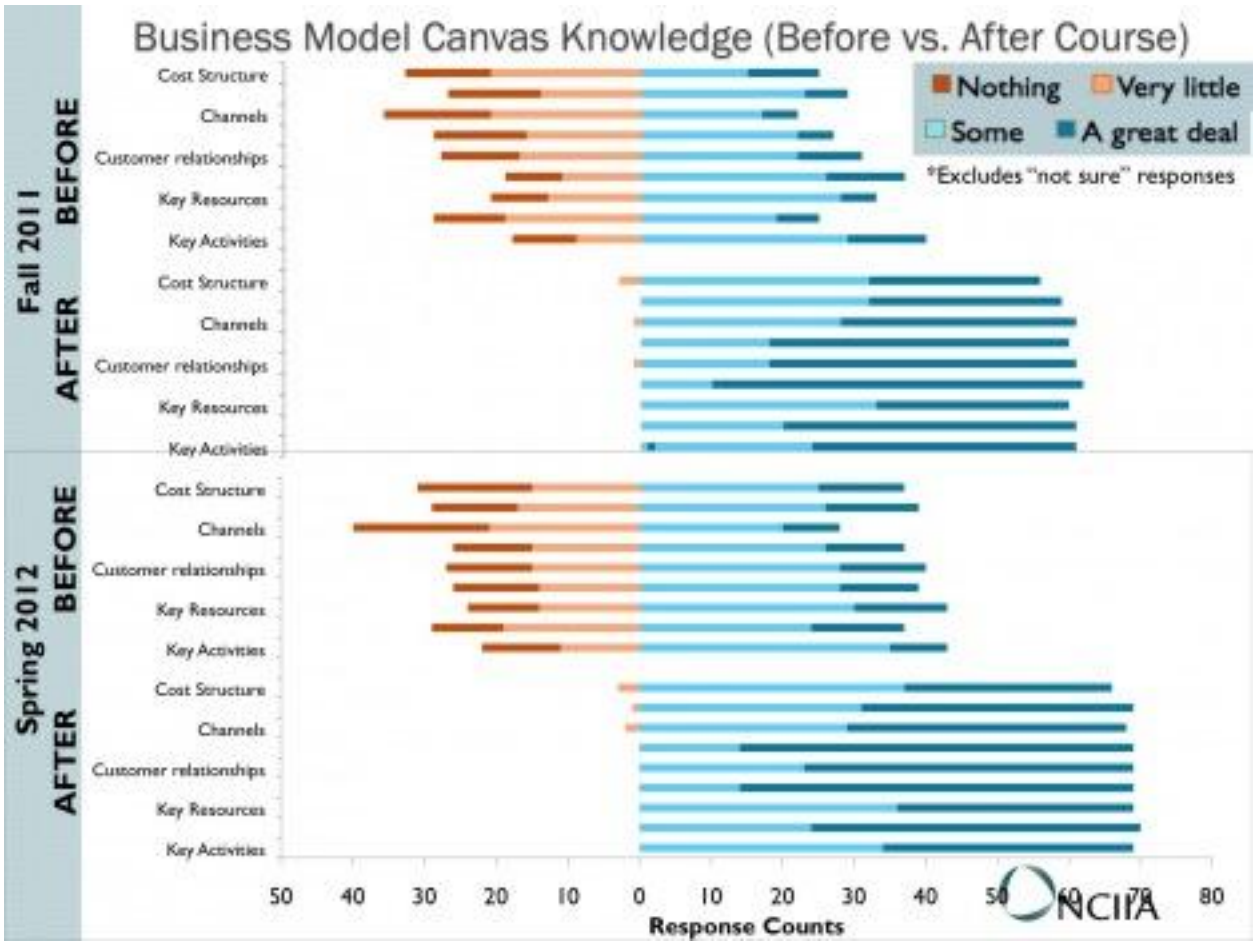
The National Science Foundation worked with NCIIA[4] to establish a baseline of what the students knew *before* the class and followed it up with a questionnaire *after* the class.

While my experience teaching *students* at Stanford, Berkeley and Columbia suggested that this class was an effective way to teach all the parts that make up a startup, would the same approach work with *academic researchers*?

Here's what we found.

Teams came into the class knowing little about what parts made up a company business model (customers, channel, get/keep/grow, revenue models, partners, resources, activities and costs.) They left with very deep knowledge.

[4] http://nciia.org/



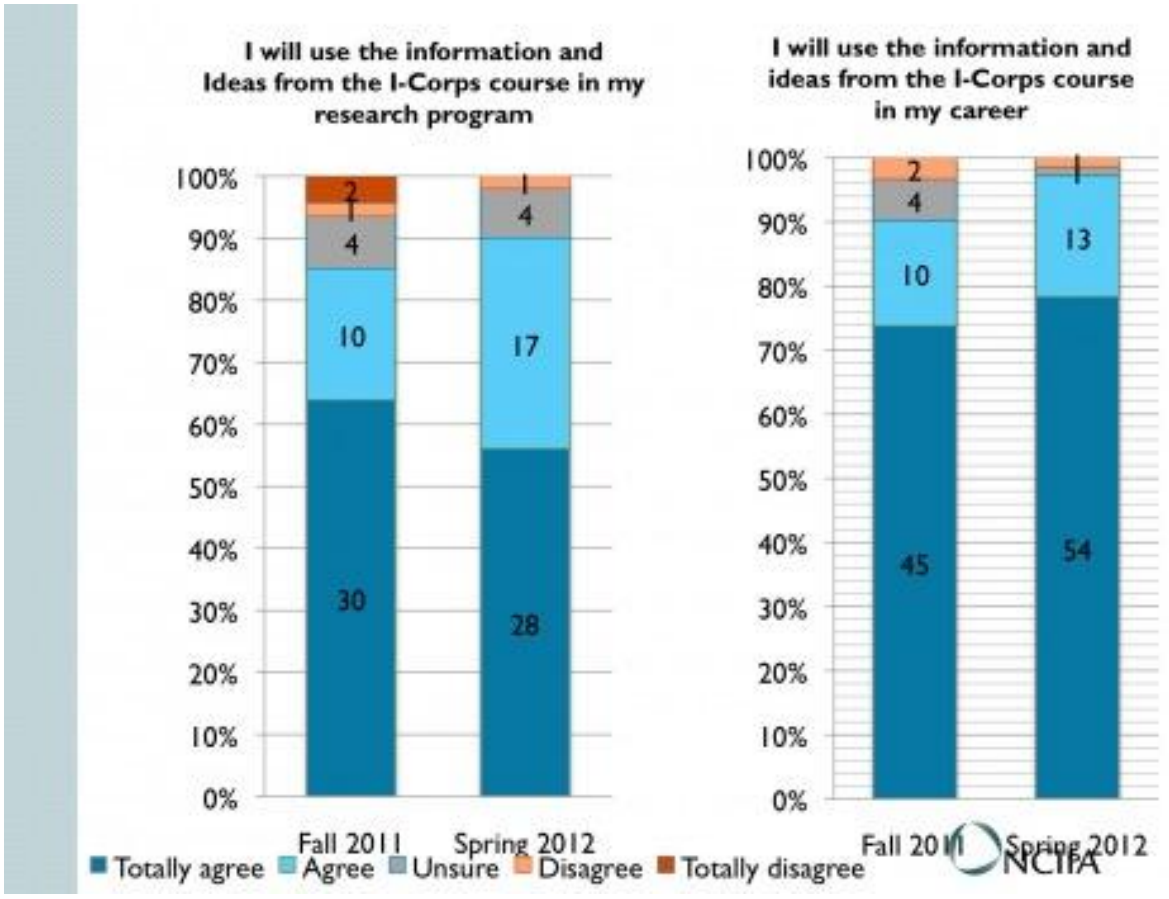
I-Corps teams spent the class refining their business model and minimum viable product.

By the end of the class:

- Over 95% believed that they found a scalable business model.
- 98% felt that they had found "product/market fit".

The class increased everyone's interest in starting a company. 92% said they were going to go out and raise money – either from the NSF or with private capital. (This was a bit astonishing given that most of them didn't know what a startup was coming in. These are new jobs being created.)

One of the unexpected consequences of the class was its effect on the Principal Investigators, (almost all tenured professors.) A surprising number said the ideas for the class will impact their research, and 98% of all of the attendees said it was going to be used in their careers.



Another unexpected result was the impact the class had on the professors' own thinking about how they would teach their science and engineering students. We got numerous comments about "I'm going to get my department to teach this."

The NSF understands that the analysis doesn't end by just studying the results of each cohort. We need to measure what happens to the teams and each of the team (Principal Investigator, Entrepreneurial Lead and Mentor) over time. It's only after a longitudinal study that will take years that we'll understand the final tally on job creation. But I think we've made a start.

Results/Recommendations

Going into the I-Corps program we had a series of our own untested hypotheses:

- Would this experiential method of teaching impart a deep understanding of what it takes to build a fundable company? The data from NCIIA says yes.
- Could we make 45-year old academics work as hard as entrepreneurs in hoodies and flip-flops? Watching them get out of their labs and talk to 100 customers in 10 weeks says yes.
- Was the I-Corps curriculum scalable? Could we train other educators to teach it? The courses being taught at Georgia Tech and the University Michigan show that we can.
- Most importantly could we bridge the missing educational gap between invention and company building? Here again the results say yes.

If we are correct about the outcome of these classes it seems logical to:

1. Recommend that the National Science Foundation require participation in an I-Corps class for all teams before receiving a Phase II grant.
2. To support this, scale the I-Corps classes to ~15 universities by the end of 2013.
3. Encourage other government research organizations to offer I-Corps training as precursor to their Phase II SBIR/STTR grants.
4. Use the NSF organizational experience in building the I-Corps program to be the cognizant agency for I-Corps across all U.S. research organizations.

In closing, what we've just seen is a government program designed, built, tested and scaled within a year. With just one-quarter of one percent of the NSF budget we've leveraged the country's commitment to research, it's partnership with private capital and its tolerance for failure in a uniquely American way. It's an extraordinarily efficient use of taxpayers' money. It will pay us back with jobs and a competitive edge on a global scale.

In short, we made a dent in the universe.

Thank you.

Acknowledgements
Thanks to the team at NCIIA that provided the analytical and logistical support to run these NSF classes. And to the team at the National Science Foundation (Errol Arkilic, Babu DasGupta) who took a chance at changing the status quo.

And thanks to the venture capitalists and entrepreneurs who volunteer their time for their country; Jon Feiber from MDV, John Burke from True Ventures, Jim Hornthal from CMEA, Jerry Engel from Monitor Ventures (and the U.C. Berkeley Haas Business School,) Oren Jacob from ToyTalk and Lisa Forssell of Pixar.

Entrepreneurship Background: Cold War Spin Outs[5]

In the 1950's the groundwork for a culture and environment of entrepreneurship were taking shape on the east and west coasts of the United States. Each region had two of the finest research universities in the United States, Stanford and MIT, which were building on the technology breakthroughs of World War II and graduating a generation of engineers into a consumer and cold war economy that seemed limitless. Each region already had the beginnings of a high-tech culture, Boston with Raytheon, Silicon Valley with Hewlett Packard.

However, the majority of engineers graduating from these schools went to work in *existing companies.* But in the mid 1950's the culture around these two universities began to change.

Stanford – 1950's Innovation

At Stanford, Dean of Engineering/Provost Fred Terman wanted companies outside of the university to take Stanford's prototype microwave tubes and electronic intelligence systems and build production volumes for the military. While existing companies took some of the business, often it was a graduate student or professor who started a new company. The motivation in the mid 1950's for these new startups was a crisis – we were in the midst of the cold war, and the United States military and intelligence agencies were rearming as fast as they could.

In 1956 Hewlett Packard, then a maker of test equipment was the valley's largest electronics employer with 900 employees. But startups were rapidly spinning out of Stanford's Applied Electronics Lab delivering microwave tubes, components and complete electronic intelligence and electronic warfare systems for the U.S. military and intelligence agencies. The future of the valley was clear – *microwaves*.

1956 – SLBMS and Semiconductors

In 1956 two events would harbor the beginning of a sea-change in innovation and entrepreneurship. At the time neither appeared earthshaking or momentous. Shockley Semiconductor Laboratory, the first semiconductor company in the valley, set up shop in Mountain View. And down the street, Lockheed Missiles Systems Division, which would become the valley's most important startup for the next 20 years, moved its new missile division from Burbank to 275 acres next to the Moffett Naval Air Station in Sunnyvale.

Lockheed, an airplane manufacturer, was getting into the missile business by becoming the prime contractor to build the Polaris, a submarine launched ballistic missile (SLBM) developed by the Navy. The Polaris was unique: it would be the first solid-fuel ballistic missile used by the U.S. Solid fuel solved the safety problem of carrying missiles at sea and underwater and also allowed for instant launch capability. Polaris launched SLBM's would become the third part of the nuclear triad the U.S. built in the cold war – the Polaris, the B-52 manned bomber, and the Minuteman, and Titan land-based

[5] http://steveblank.com/secret-history/

Intercontinental Ballistic Missiles (ICBMs.)

10 years after the program started the United States had built and put to sea 41 ballistic missile submarines carrying 656 Lockheed missiles. Lockheed built close to 1000 of these missiles in those ten years. That's 100 missiles a year, 8/month or 2 a week flying out of Moffett Field in the heart of what would become Silicon Valley.

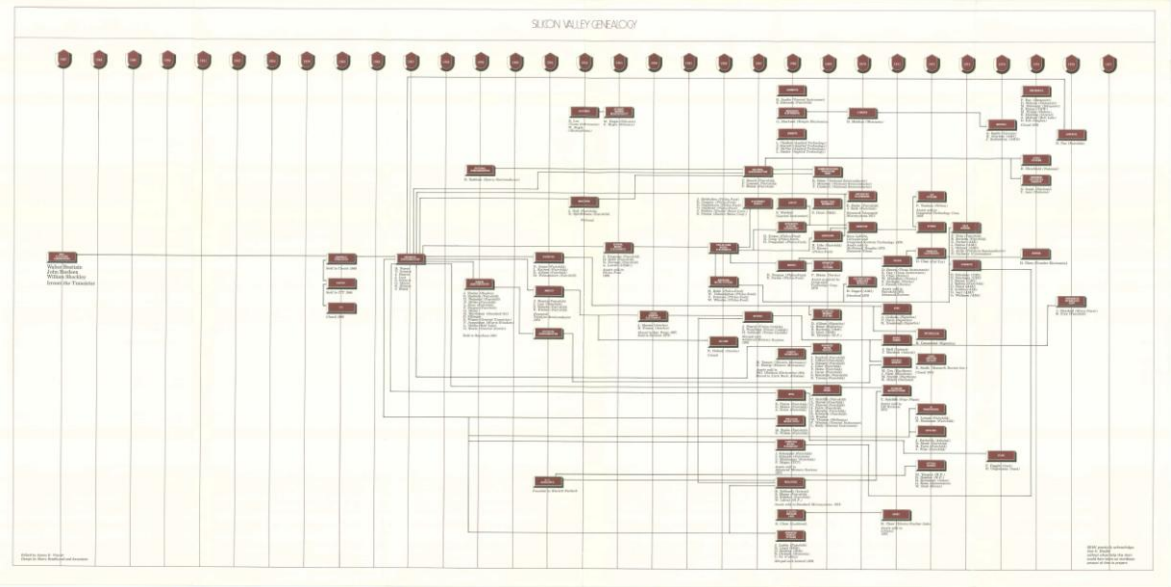
Zero to 28,000 people – We Become "Defense Valley"
By 1965 Hewlett Packard, the test and instrumentation company, had grown ten-fold. From 900 people in 1956 it now employed 9,000. Clearly it must have been the dominant company in the valley? Or perhaps it was Fairchild, the direct descendant of Shockley Semiconductor, now the dominant semiconductor supplier in the valley (80% of its first years business coming from military systems) with ~10,000 people?

Nope, it was the Lockheed Missiles Division, which had zero employees in 1956, now in 1965 *had 28,000 employees in Sunnyvale*. The best and the brightest were coming from across the country to the valley south of San Francisco.

And they were not only building Polaris missiles.

By 1965 Lockheed factories in Sunnyvale, Stanford and East Palo Alto *were building spy satellites for the CIA, NSA and NRO.* While the 1950′s had made the area south of San Francisco "Microwave Valley," the growth of Lockheed, Westinghouse and their suppliers had turned us into "Defense Valley."

Why It's "Silicon" Valley
While 1956 was the beginning of massive government funding in what would become Silicon Valley, entrepreneurship as we now know it began to emerge in a very small and inconspicuous way. Shockley Semiconductor Laboratory, the first semiconductor company in the valley, set up shop in Mountain View. Fifteen months later eight of Shockley's employees (three physicists, an electrical engineer, an industrial engineer, a mechanical engineer, a metallurgist and a physical chemist) quit Shockley and founded Fairchild Semiconductor. (Every chip company in Silicon Valley can trace their lineage from Fairchild.)



The history of Fairchild was one of applied experimentation. It wasn't pure research, but rather a culture of taking sufficient risks to get to market. It was learning, discovery, iteration and execution. The goal was commercial products, but as scientists and engineers the company's founders realized that at times *the cost of experimentation was failure.* And just as they don't punish failure in a research lab, they didn't fire scientists whose experiments didn't work. Instead the company built a culture where when you hit a wall, you backed up and tried a different path. (In 21st century parlance we say that innovation in the early semiconductor business was all about "pivoting" while aiming for salable products.)

The Fairchild approach would shape Silicon Valley's entrepreneurial ethos: *In startups, failure was treated as experience* (until you ran out of money.)

Scientists and Engineers as Founders

In the late 1950's Silicon Valley's first three Initial Public Offerings (IPO's) were companies that were founded and run by scientists and engineers: Varian (founded by Stanford engineering professors and graduate students,) Hewlett Packard (founded by two Stanford engineering graduate students) and Ampex (founded by a mechanical/electrical engineer.) While this signaled that investments in technology companies could be very lucrative, both Shockley and Fairchild could only be funded through corporate partners – there was no venture capital industry. But by the early 1960′s the tidal wave of semiconductor startup spinouts from Fairchild would find a valley with a growing number of U.S. government backed venture firms and limited partnerships.

A wave of innovation was about to meet a pile of risk capital.

For the next two decades venture capital invested in things that ran on electrons: hardware, software and silicon. Yet the companies were anomalies in the big picture in the U.S. – there were almost no MBA's. In 1960's and '70's few MBA's would give up a lucrative

career in management, finance or Wall Street to join a bunch of technical lunatics. So the engineers taught themselves how to become marketers, sales people and CEO's. And the venture capital community became comfortable in funding them.

Medical Researchers Get Entrepreneurial

In the 60's and 70's, while engineers were founding companies, medical researchers and academics were skeptical about the blurring of the lines between academia and commerce. This all changed in 1980 with the Genentech IPO.

In 1973, two scientists, Stanley Cohen at Stanford and Herbert Boyer at UCSF, discovered recombinant DNA, and Boyer went on to found Genentech. In 1980 Genentech became the first IPO of a venture funded biotech company. The fact that serious money could be made in companies investing in life sciences wasn't lost on other researchers and the venture capital community.

Over the next decade, medical graduate students saw their professors start companies, other professors saw their peers and entrepreneurial colleagues start companies, and VC's started calling on academics and researchers and speaking their language.

Scientists and Engineers = Innovation and Entrepreneurship

Yet when venture capital got involved they brought all the processes *to administer existing companies* they learned in business school – how to write a business plan, accounting, organizational behavior, managerial skills, marketing, operations, etc. This set up a conflict with the learning, discovery and experimentation style of the original valley founders.

Fifty years later we now know the engineers were right. Business plans are fine for large companies where there is an existing market, product and customers, but in a startup all of these elements are unknown and the process of discovering them is filled with rapidly changing assumptions.

Startups are not smaller versions of large companies. Large companies execute known business models. In the real world a startup is about the *search* for a business model or more accurately, *startups are a temporary organization designed to search for a scalable and repeatable business model*.

Yet for the last 40 years, while technical founders knew that *no business plan survived first contact with customers,* they lacked a management tool set for *learning, discovery and experimentation*.

In 2011 we taught a class in the Stanford Technology Ventures Program, (the entrepreneurship center at Stanford's School of Engineering), based on my previous Stanford and U.C. Berkeley courses, to provide scientists and engineers just those tools – how to think about *all* the parts of building a business, not just the product. The Stanford Lean LaunchPad class introduced the first *management tools for entrepreneurs* built around the business model / customer development / agile development solution stack.

With the NSF Innovation Corps, *scientists and engineers now have a methodology to rapidly take commercialize their research*.

The Innovation Corps/Lean LaunchPad: Management tools for entrepreneurs

One of the things startups have lacked is a definition of who they were. For years we've treated startups like they are just smaller versions of large companies However, we now know that a startup is a *temporary organization designed to search for a repeatable and scalable business model.* Within this definition, a startup can be a new venture or it can be a *new division or business unit in an existing company*.

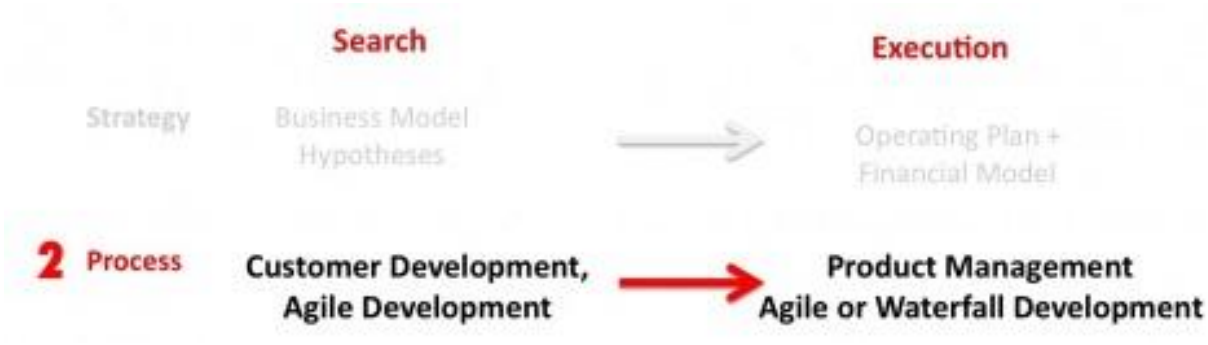
If your business model is *unknown*—that is, just a set of untested hypotheses—you are a startup *searching* for a repeatable business model. Once your business model (market, customers, features, channels, pricing, Get/Keep/Grow strategy, etc.) is *known*, you will be *executing* it. *Search* versus *execution* is what differentiates a new venture from an *existing* business unit.

Strategy

The term "business model" first appeared around 50 years ago, but the concept didn't catch on until the 1990's. It became common vernacular to discuss business models, but without a standard framework and vernacular, confusion reigned. In 2010, when Alexander Osterwalder published his book, Business Model Generation, he provided a visual ontology and a clear vernacular that was sorely needed, and it became clear that this was the tool to organize startup hypotheses.

The primary objective of a startup is to validate its business model hypotheses until it finds one that is repeatable and scalable (it continues to iterate and pivot until it does.) Then it moves into *execution* mode. It's at this point the business needs an operating plan, financial forecasts and other well-understood management tools.

Process



Yet as powerful as the Business Model Canvas (a template with the nine blocks of a business model) is, at the end of the day it was a tool for brainstorming hypotheses without a formal way of testing them.

The *processes* used to organize and implement the search for the business model are *Customer Development* and *Agile Development*. A search for a business model can occur in any new business—in a brand new startup new or in a new division of an existing company.

The Customer Development model breaks out all the customer-related activities of an early-stage company into four easy-to-understand steps. The first two steps of the process outline the "search" for the business model. Steps three and four "execute" the business model that's been developed, tested, and proven in steps one and two. The steps:

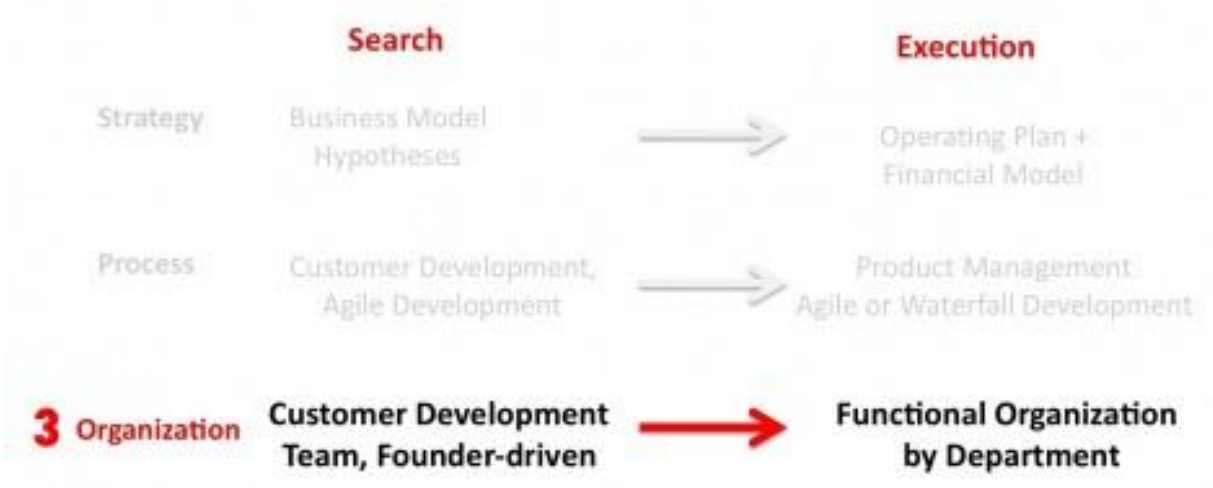
- *Customer discovery* first captures the founders' vision and turns it into a series of business model hypotheses. Then it develops a plan to test customer reactions to those hypotheses and turn them into facts.
- *Customer validation* tests whether the resulting business model is repeatable and scalable. If not, you return to customer discovery.
- *Customer creation* is the start of execution. It builds end-user demand and drives it into the sales channel to scale the business.
- *Company-building* transitions the organization from a startup to a company focused on executing a validated model.

In the "search" steps, you want a process designed to be dynamic, so you work with a rough business model description knowing it will change. The business model changes because startups use customer development to run experiments to test the hypotheses that make up the model. (First testing their understanding of the customer problem and then solutions.) Most of the time these experiments fail. *Search embraces failure as a natural part of the startup process.* Unlike existing companies that fire executives when they fail to match a plan, *we keep the founders and change the model*.

Once a company has found a business model (it knows its market, customers, product/service, channel, pricing, etc.), the organization moves from search to execution.

The product execution process—managing the lifecycle of existing products and the launch of follow-on products—is the job of the product management and engineering organizations. It results in a *linear process* where you make operating plans and refine them into detail. The more granularity you add to a plan, the better people can execute it: a Business Requirement document (BRD) leads to a Market Requirements Document (MRD) and then gets handed off to engineering as a Functional Specifications Document (FSD) implemented via Agile or Waterfall development.

Organization

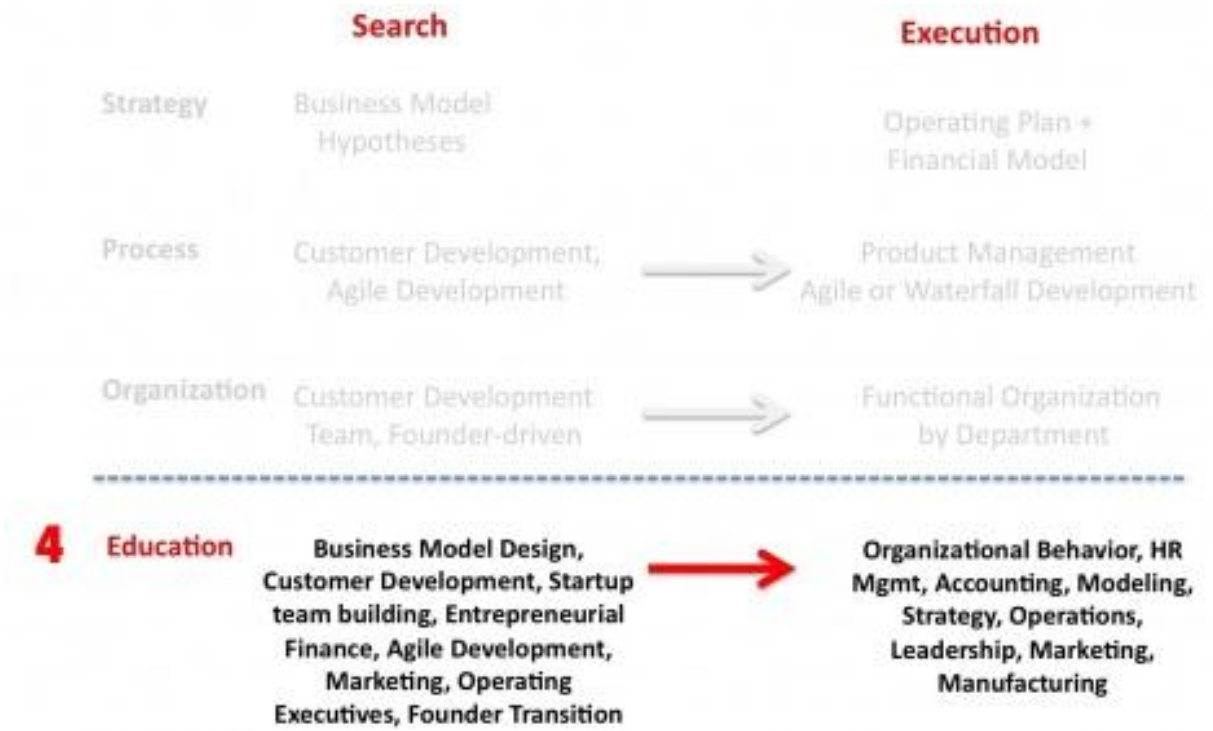


Searching for a business model *requires a different organization* than the one used to execute a plan. *Searching* requires the company to be organized around a *customer development team* led by the founders. It's only the founders who can make the strategic decisions to iterate and/or pivot the business model, and to do that they need to hear customer feedback directly. In contrast, execution (which follows search) assumes that the job specifications for each of the senior roles in the company can be tightly authored. Execution requires the company to be organized by function (product management, sales, marketing, business development, etc.)

Companies in execution suffer from a "fear of failure culture," quite understandable since they were hired to execute a known job spec. Startups with Customer Development Teams have a "learning and discovery" culture for search. The fear of making a move before the last detail is nailed down is one of the biggest problems existing companies have when they need to learn how to search.

The idea of not having a functional organization until the organization has found a proven business model is one of the hardest things for new startups to grasp. *There are no sales, marketing or business development departments when you are searching for a business model*. If you've organized your startup with those departments, you are not really doing customer development. (It's like trying to implement a startup using Waterfall engineering.)

Education



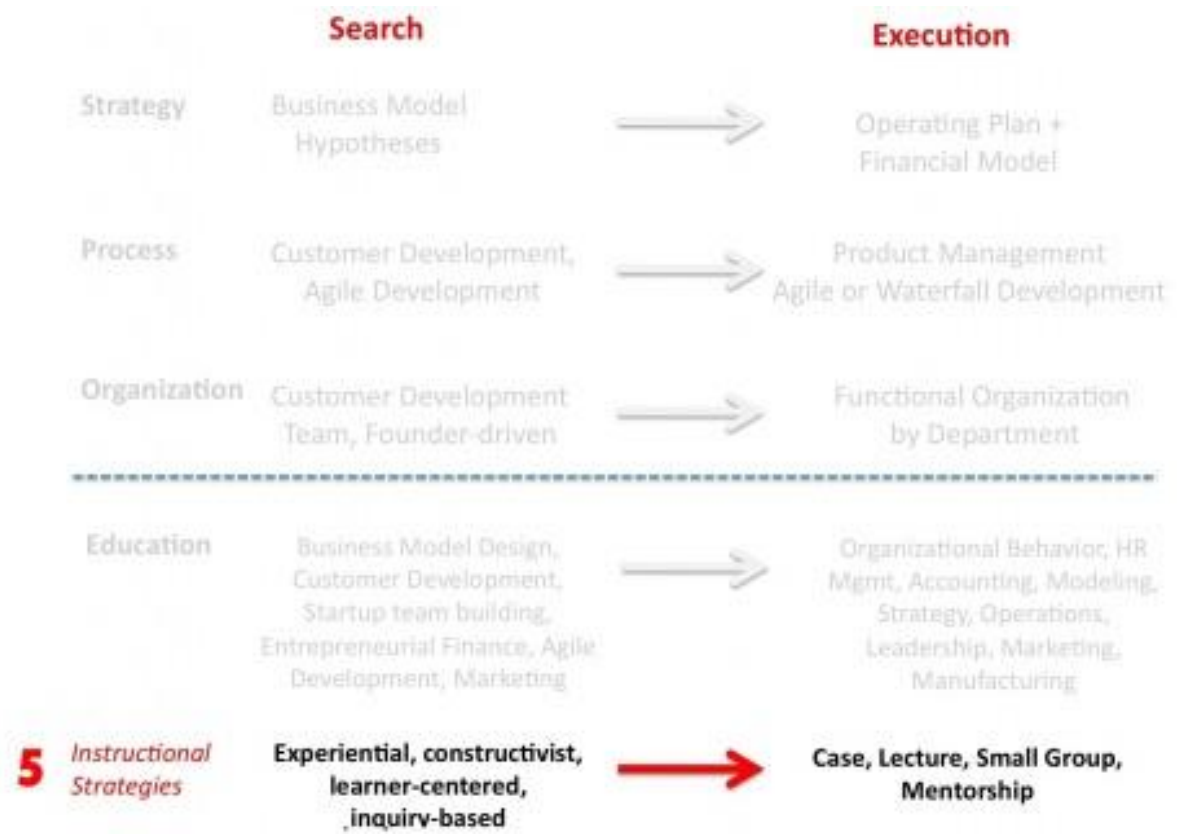
Entrepreneurship curricula are only a few decades old. First taught as electives and now part of core business school curricula, the field is still struggling to escape from the bounds of the business plan-centric view that startups are "smaller versions of a large company." Venture capitalists who've watched as *no startup business plan survived first contact with customers* continue to insist that startups write business plans as the price of entry to venture funding. This continues to be the case even as many of the best VCs understand that *business "planning,"* and *not the "plan"* itself, is what is important.

The trouble is that over time, this key message has gotten lost. As business school professors, many of whom lack venture experience, studied how VCs made decisions, they observed the apparently central role of the business plan and proceeded to make the plan, *not the planning*, the central framework for teaching entrepreneurship. As new generations of VCs with MBAs came into the business, they compounded the problem ("that's how we always done it" or "that's what I learned (or the senior partners learned) in business school.")

Entrepreneurship educators have realized that a plan-centric curriculum may get by for teaching incremental innovation but won't turn out students prepared for the realities of building new ventures. Educators are now beginning to build their own *E-School* curriculum with a *new class of* management tools built around "search and discovery." Business Model Design, Product/Service Development, Customer Development, Startup Team-Building, Entrepreneurial Finance, Marketing, Founder

Transition, etc., all provide the startup equivalent of the management tools MBAs learn for execution.

Instructional Strategy



Entrepreneurial education is also changing the focus of the class experience from case method to hands-on experience. Invented at Harvard, the case method approach assumes that knowledge is gained when students actively participate in a discussion of a situation that may be faced by decision makers.

But the search for a repeatable business model for a new product or service is not a predictable pattern. An entrepreneur must start with the belief that all her assumptions are simply hypotheses that will undoubtedly be challenged by what she learns from customers. Analyzing a case in the classroom removed from the realities of chaos and conflicting customer responses adds little to an entrepreneur's knowledge. Cases can't be replicated because the world of a startup too chaotic and complicated. The case method is the antithesis of how entrepreneurs build startups—it teaches pattern recognition tools for the wrong patterns—and therefore has limited value as a tool for teaching entrepreneurship.

The replacement for the case method is not better cases written for startups. Instead, it would be business model design; using the business model canvas as a way to 1) capture and *visualize the evolution* of business learning in a company, and 2) see what *patterns*

match real world iterations and pivots. It is a tool that better matches the real-world search for the business model.

In addition, teaching for the Lean LaunchPad class is typically done with a "flipped classroom." Here, the lectures are homework (as interactive videos) and the homework (testing hypotheses in front of customers) is the classroom discussion as all teams present. To keep track of the students' customer discovery progress, we use an on-line tool (LaunchPad Central) to record the week-by-week narrative of their journey.

An entrepreneurial curriculum obviously will have some core classes based on theory, lecture and mentorship. There's embarrassing little research on entrepreneurship education and outcomes, but we do know that students learn best when they can connect with the material in a hands-on way, personally making the mistakes and learning from them directly.

As much as possible, the emphasis ought to be on experiential, learner-centric and inquiry-based classes that help to develop the mindset, reflexes, agility and resilience an entrepreneur needs to search for certainty in a chaotic world.

I-Corps Lean LaunchPad Pedagogy – Experiential Learning and a Flipped Classroom

The Lean LaunchPad is a hands-on program that immerses teams in testing their business model hypotheses outside the classroom. Inside the classroom, it deliberately trades off lecture time for student/teaching team interaction.

The Lean LaunchPad uses the Customer Development process and the business model canvas to collapse the infinite possibilities of a startup into a solvable problem.

Experiential Learning
Experiential learning has been around forever. Think of the guilds, apprentices, etc. Mentors were the master craftsmen. That's the core idea of this class.

The I-Corps class uses *experiential learning* as the paradigm for engaging the participants in discovery and hypotheses testing of their business models. From the first day we meet, the teams get out of the classroom and learn by doing.

This is very different from how a business school, "how to write a business plan" class works. There, it assumed a priori a valid business model. In this Lean LaunchPad class, the teams are *not* building a business (yet). Information they learn from customers will validate/invalidate their hypotheses (thesis), and the teams will modify the business model (iterate or pivot). This results in the teams bringing market needs forward. Then they can decide if there's a business to be built.

What this class does not include is execution of the business model. In this course, implementation is all about discovery outside of the classroom. Once discovery has

resulted in a high degree of confidence that a viable business model exists, it is time to create an execution plan. If the teams continue with their companies, they will assemble the appropriate operating plans (financial models, revenue plans, etc.)

The Flipped Classroom
Rather than classroom lectures by an instructor in the weeks we are remote and online, the lectures have now become homework. Students will watch a lecture on each component of the business model canvas, take a short quiz and have access to a class forum for questions. Their homework for that week assumes they will use that new knowledge to test that specific part of the business model.

Innovation Corps - Course Logistics

In week 1, students attend 3 days of on-site training at a NSF-designated university. Half the days are team presentations and critiques plus in-person lectures, and the other half consists of getting out of the building and talking to customers.

For the next 5 weeks, back at their universities, teams spend 10-15 hours a week talking to customers.

In addition, each week, teams spend two hours on-line as they present their findings via WebEx and hear their peers' presentations

During the week, they watch an interactive lecture on a portion of the business model canvas

In Week 8, they reconvene at the same at a NSF-designated university for one day of presentation training, and another for the final "Lessons Learned" presentations.

Classes
For each weekly class session, there are:
- Pre-class readings
- A pre-recorded on-line lecture with quizzes
- An in-class team 10-minute presentation
- Weekly assignment to get out of the building and test one of the business model components with 10+ customers

Each week's class session is organized around:
- Team presentations on their "lessons learned" from talking with customers and iterating or pivoting their business models.
- Lectures:
    - For the first week, three in-person business model lectures;
    - Online, in weeks 2-6, lectures are assigned as homework with quizzes

Week	Location	Lecture	Topic
Week 1	On-site	Lecture 1	Intro, Business Models, and Customer Development
	On-site	Lecture 2	Value Proposition
	On-site	Lecture 3	Customers
Week 2	On-line, self paced	Lecture 4	Channels
Week 3	On-line, self paced	Lecture 5	Customer Relationships Get/Keep/Grow
Week 4	On-line, self paced	Lecture 6	Revenue Model
Week 5	On-line, self paced	Lecture 7	Partners
Week 6	On-line, self paced	Lecture 8	Resources and Costs
Week 8	On-Site	Lecture 9	Presentation Skills Training
	On-Site	Lecture 10	Lessons Learned Presentations

Innovation for the 99%

While we're excited by the results of the NSF Innovation Corps, we've realized that this program just solves the problem for the 1% of new ventures that are technology startups. The reality is that the United States is still a nation of small businesses. 99.7% of the ~6 million companies in the U.S. have less than 500 people and they employ 50% of the 121 million workers getting a paycheck. They accounted for 65 percent (or 9.8 million) of the 15 million net new jobs created between 1993 and 2009. And while they increasingly use technology as a platform and/or a way of reaching and managing customers, most are in non-tech businesses (construction, retail, health care, lodging, food services, etc.)

While we were figuring out how to be incredibly more efficient in building new technology startups, three out of 10 new small businesses will fail in 2 years, half fail within 5 years. The tools and techniques available to small businesses on Main Street are the same ones that were being used for the last 75 years.

Therefore, our remaining challenges are *how to make them fail less* – and how can we make the Lean LaunchPad approach relevant to the rest of the 99% of startups.

Business plans are obsolete for Main Street
Our first insight was that the traditional "how to write a business plan" *was as obsolete for Main Street as it is for Silicon Valley*.

In most communities building a successful venture that generated nice cash flows – not IPO's – were the big win. To his students these were not "small businesses", but 'their businesses', their livelihoods and their opportunities to create wealth and independence for themselves and their families.

While the teachings of the Lean LaunchPad directly applicable and effective to small businesses, there is a mismatch in the size of the end goal (a great living versus a billion dollar IPO) and the details of the implementation of the business model (franchise and multilevel marketing versus direct sales, profit sharing versus equity for all, family and

SBA loans versus venture capital, etc.)

We can easily adjust *the NSF Innovation Corps class to bring 21st century entrepreneurship techniques to 'Main Street'*. To do this we needed to do is change the end goals and implementation details to match the aspirations and realities that these new small businesses face.

We called this Main*stream* Entrepreneurship.

Mainstream Entrepreneurship

Mainstream Entrepreneurship recognizes that with the Lean LaunchPad class we now have a methodology of making small businesses fail less. That accelerating business model search and discovery and using guided customer engagement as a learning process, we could help founders of mainstream businesses just like those starting technology ventures. For the rest of the afternoon, Steve and I brainstormed with Alex about how he could take his 20 years of entrepreneurial small business experience and use the Business Model Canvas and Customer Development to create a university entrepreneurship curriculum and vocabulary for the mainstream of American Business.