Educating Venture Scientists

Inspiring students and young professionals to commercialize their deep tech research supported by their Institutions.

Philip Treleaven[1]
University College London (UCL)

Abstract

Students and young professionals are truly energized by pursuing deep tech research that can underpin a successful Tech Start-up. This global innovation strategy is inspired by role model students at premier US universities.

The Venture Scientist paradigm emphasizes having a great (tech) idea, assembling a stellar team often fellow students, building a proof of concept (POC) or minimal viable product (MVP), and finding launch partners who love the concept. We believe this is a major emerging innovation paradigm, and that universities and governments should *institutionalize* support creating vibrant enterprise ecosystems. Importantly, the Venture Scientists paradigm has major educational benefits, is low risk, and avoids having to pick Start-up winners which is notoriously difficult (cf., *let a thousand flowers bloom*).

This paper discusses how students can be educated, inspired, and supported by their universities, drawing on my own department UCL Computer Science as a case study.

1. Venture Scientists

Increasingly tech students and young professionals are pursuing 'guerrilla' commercialization of their research projects in universities, government labs and companies. Inspired by legendary tech role models such as Bill Gates, Larry Page, Sergey Brin, Mark Zuckerberg, Sam Altman etc. It contrasts with the traditional business school entrepreneurship model of chasing venture capital.

In perspective, the Venture Scientist paradigm can be seen as a natural progression from *pure* research in the 60s, *applied* research in the 70s, to *collaborative* research between academia and industry in the 80s-90s, and on to *enterprise* research; researcher-led impact and commercialization.

In the 80s and 90s government *collaborative* research programs (e.g., US DARPA, EU ESPRIT/HORIZON) were initiated to drive technical innovation. These collaborative programs are good at knowledge transfer between universities and corporates. However, corporates can be notoriously slow to innovate. In contrast, universities (e.g., Stanford, Cambridge) have encouraged their students and young academics to drive research impact and start-up commercialization. Tech students, our principal focus, also learn valuable business skills not traditionally taught in universities.

Great Start-ups

Successful tech start-ups focus on ground-breaking ideas, founder teams and partners, and building a POC/MVP rather than fund raising. They have the following attributes (Altman, 2022):

- **Excellence –** an idea and product so good people will tell their friends.
- **Clarity -** easy to understand idea and product 'elevator pitch'.
- **Market** – potential exponential growth in market; product addressing a real trend (iPhone) versus an illusory trend (AR Headset).
- **Promotion** - evangelical founder to 'sell' the product and start-up; with founders having a definite view of future.
- **Team** – the need to assemble a 'dream' team of founders and key staff, with ambition and confidence in

[1] Address for correspondence p.treleaven@ucl.ac.uk

the success of their product and start-up.

- **Action** – determination to build the product and commercialize it, as opposed to *analysis paralyses*.
- **Nimble** – ability to pivot and refocus in a fast-changing market.

An observation: many tech students can be obsessed with their world-class technology, rather than building a product customers want to buy. Here alumni and professionals can be invaluable as mentors and co-founders.

Enterprise Assembly Line
Successful Venture Scientist programs start with nurturing talent and importantly are a fully integrated innovation *assembly line* linking technical talent, ideas, mentoring, prototype development, professional co-founders, client engagement etc. Governments are fixated on funding, universities on incubators and IPR ownership, and business schools chasing venture capital.

Importantly students need the prerequisite technical skills and support themselves to build a pioneering POC/MVP product. Figure 1 illustrates the enterprise assembly line.

the most important tool to achieving success, overriding both talent and resources by far. Contrast ambition in the United States (e.g., Silicon Valley) with Europe, and immigrants versus the local population.

Enterprise ethos
Some considerations and issues to be addressed:

- **Students** – many Academics believe students only learn research skills as part of the Academic's team, prioritizing scholarship over product experimentation and often discouraging outside collaborations. The digital domain offers students a great source of ideas, and even young students have the technical knowledge to underpin the core research and build products.
- **Universities** – university enterprise programs frequently focus on supporting established Academics, but their promotion is largely based on peer-reviewed publications in prestigious academic journals. In contrast, students are 'free agents' inspired by applied research, potential impact and launching start-ups.

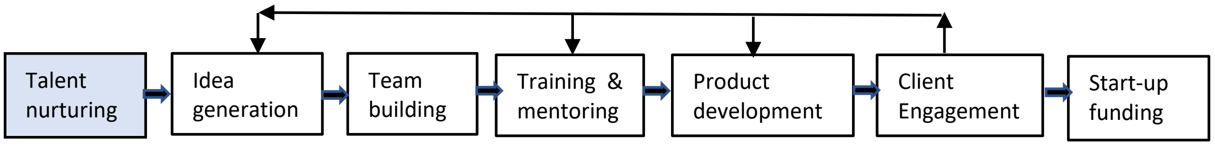

Figure 1: Enterprise 'assembly line'

2. Tech Entrepreneurship

As discussed, the Venture Scientist paradigm focuses on building a prototype: identifying a great idea, assembling a 'dream' team (often fellow students), and engaging with mentors, co-founders, and reference clients. Low risk ingredients for exploring ideas, and co-creating a POC/MVP with partners, supported by their institution. Fund raising – although necessary to some extent – isn't in itself the 'secret sauce' for success.

In nurturing an enterprise ecosystem, instilling ambition in Venture Scientists is clearly important. Seeing their peers achieve success is inspirational. As often quoted: *ambition is*

- **Intellectual property rights (IPR)** – traditionally universities seek ownership of staff and student IPR, disregarding associated benefits of letting inventors keep their IP, thereby encouraging start-ups, donations from successful entrepreneurs, and reputation for innovation). Fortunately, a few universities, including UCL (my own university), allows students to control their IP (www.ucl.ac.uk/enterprise/about/governance-and-policies/ucl-intellectual-property-ip-policy). Another example is the University of Waterloo, Canada 'Creator-own' IP policy.

- **Tech start-ups** – students pursuing deep tech research are well placed and motivated to spot opportunities. In addition, a tech start-up underpinned by unique research creates so-called *barriers to entry*. This is the cost or other obstacles that prevent new competitors from easily entering an industry or area of business.
- **Tech talent**– it is increasingly important for all students to have the technical training (e.g., programming, data science, AI etc.) to identify an emerging opportunity and themselves build a POC/MVP. This is graphically demonstrated by the emergence of ChatGPT and generative AI, fast becoming the new must-have TI skills for business professionals.

Once a start-up has a POC/MVP, team and especially paying clients raising start-up funding (e.g., \$1m⁺) becomes viable. The challenge is the seed stage (e.g., \$80k⁺), where the start-up is building a POC/MVP and has no clients. Funding solutions include academic grants to support the underpinning research, university fellowships, and incubator programs, such as YCombinator.com and EntrepreneurFirst.com.

Institutionalizing support

Universities (and corporations) are natural incubators. Mechanisms put in place for supporting entrepreneurship include training, mentoring, seed funds and physical incubators etc. Crucially, they need to be a fully integrated innovation *assembly line* (see Figure 1). Considerations include:

- **Talent** – university entrepreneurship training often focuses on management (e.g., business plans, financial forecasts, and fund raising). As argued, student research training needs to focus on experimentation, building a product and engaging with partner clients, rather than just peer-reviewed papers.
- **Soft funding** – traditionally students are encouraged to chase start-up funding, even to the detriment of building a POC/MVP. In contrast, Venture Scientists can benefit from early-stage university 'soft' funding including research grants, entrepreneurship fellowships, institutional funds, even to some extent student grants. Research grants and fellowships allow aspiring entrepreneurs to develop their POC/MVP, without eroding equity or intellectual property rights (IPR).
- **Incubators –** currently physical incubators and accelerators are popular with universities. While physical incubators clearly demonstrate institutional support, today, founders can simply collaborate online or use their institution's facilities as a hot-desking co-working space. Although UCL has a physical incubator, UCL Computer Science (CS) promotes entrepreneurship with a 'venture scientist' induction lecture to new students.
- **Mentors/Co-founders** – although many academics actively discourage their students from engaging with companies, one of the hugely valuable contributions is founders collaborating with professionals as mentors and co-founders. Here alumni can be a great resource. Frequently young Venture Scientists have great technical skills but typically lack business development expertise.

3. Educational Case Study

Using UCL Computer Science as a case study, we are fortunate in being in Central London with easy access to world-class companies, start-ups, and public sector organizations with whom we collaborate.

UCL CS has 300 PhD students, 650 Masters students and 500 Undergrads highly skilled in machine learning, blockchain, IoT, cyber security, Robotics, User Interface, etc. Our two most successful departmental initiatives are: a) *company internships* - having students undertake their research projects (PhD, Masters, Final Year Undergrad) in partnership with an external institution, and b) *tech start-ups* - encouraging students to view their research projects as precursors for a start-up.

- **Company internships** – most students do their research projects with outside institutions, supporting institutional innovation and student employability. The Department's Industry Exchange Network (www.ucl.ac.uk/computer-science/collaborate/ucl-industry-exchange-network-ucl-ixn) facilitates links, IPR assignment and contractual arrangements.
- **Student start-ups** – an increasing number of students now use their research projects to pursue tech start-ups, in parallel to their formal education. It is especially popular with PhD students, pursuing deep tech research projects with support by the UK ConceptionX program (www.conceptionx.org).

As a starting point, we encourage students pursuing a start-up to prepare a simple 'pitch deck' PowerPoint to focus their ideas (see Figure 2) and as a basis for mentoring and recruiting co-founders.

The 'pitch deck' covers:

- **Branding** – a compelling project name, available URL, and a 'strapline' or 'elevator pitch'.
- **Vision** – the vision and unique selling proposition (USP) for the project: where to start and future potential for a launch.
- **Opportunity** – why business or society really needs the proposed tech product or service.
- **Team** – the 'founder' team and roles. This covers Chief Executive and Chief Technology Offices, Chief Scientist, Advisors etc.; with placeholders for members that need to be recruited.
- **Product** – a description of the research, technology and infrastructure being developed.
- **Ideal customer profile** – the attributes of an ideal customer.
- **Launch strategy** – description of the initial research, proof-of-concept (POC) and minimal viable product (MVP), should the project evolve to a start-up.
- **Competitors** – potential competitors and an analysis of their strengths and weaknesses.

The Department promotes the Venture Scientist paradigm to students:

- **Student induction** – during induction, students receive a Venture Scientist lecture that explains the concept, using student case studies.
- **Tech Entrepreneurship course** – the Department provides a 30-lecture entrepreneurship course, which students can take for credit or audit.
- **Digital Incubator** – to support 'matchmaking' between students, alumni, and professionals, we have a digital incubator for internships, research project teams, and start-ups. Start-up ideation comes from students but increasingly from external entrepreneurs seeking partnerships.

Tech Entrepreneurship course

The 30-lecture course focuses on start-up culture and experience; and is unique in being taught by a team of 12 experienced professionals: alumni (female) entrepreneurs, venture capitalists (VCs), and experts, such as tech lawyers and accountants. The students are encouraged to identify a compelling tech start-up idea, begin the development of a POC, and integrate the POC with their (PhD, Masters, or Final Year) research project. The content is more knowledge transfer from professionals rather than academic.

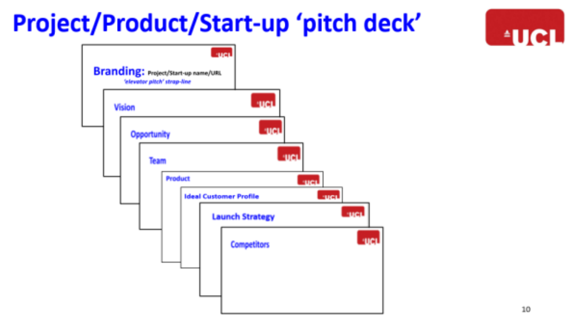

Figure 2: Start-up planning PowerPoint

	Week Theme	Theory lecture	Practice lecture	Case Study
1.	***Course organisation***	Venture scientist paradigm	UCL Innovation support	UCL CS alumni spin-out
2.	***Digital innovations***	AI, Blockchain, NLP, IST etc.	FinTech and DeFi	UCL CS student start-up
3.	***Life science innovations***	Life science technologies	Life science opportunities	UK ConceptionX program
4.	***Business planning***	Pitch deck, model canvas	Business plan	UCL CS Trade sale
5.	***Business model strategies***	Business model strategies	Growing your business	UCL major tech company
6.	***Start-up value proposition***	Value proposition design	Lean start-up/Agile product	Start-up case studies
7.	***Funding & Venture Capital***	Funding types & sources	Funding strategies & exits	High-profile Start-up VC
8.	***Financials for Founders***	Financial models	Running your business	Start-up case study
9.	***Legals***	Company legal documents	Legal structures for Start-up	Major crypto lawyer
10	***Coursework workshop***			

Figure 3: Tech Entrepreneurship 30-lecture course

Assessment is all practical coursework-based covering: pitch deck, start of their POC, whitepaper, business model canvas, business plan, financials, and a company promotional video etc. My favorite being a 'rapper' video on YouTube.

Digital Incubator – TechIntern.Work

As discussed, UCL Computer Science's two most successful departmental initiatives are: a) *Company internships* for student research projects and summer work placements, and b) *Student start-ups* initiated by students, alumni, and professionals. The big challenge is *matchmaking*.

To support the escalating interest in technical internships and start-ups, we have a 'digital incubator' *pre*web platform, starting with an internship *matchmaker*. The platform, called TechIntern.Work, links students at premier universities and companies, to offer internships, and research projects. This platform is being expanded for entrepreneurship: start-ups, major research projects and regional innovation hubs.

Lastly, two interesting developments in UCL CS are: firstly, professionals returning to university to undertake part-time PhDs, plus Masters programs in Machine Learning, Blockchain and Information Security etc.; and secondly, alumni continuing to work with the Department after graduating. This includes alumni offering internships, mentoring, and also alumni founding tech start-ups. A rich innovation ecosystem is developing.

4. UK ConceptionX PhD programme

Central to the Venture Scientists paradigm is the enterprise 'assembly line' (see Figure 1) from nurturing talent to thriving start-up. The UK ConceptionX PhD program (www.ConceptionX.org) provides an exemplar for this end-to-end enterprise 'assembly line'. Originally supported by UCL, the programme was founded by Dr Riam Kanso (*a tour-de-force*) as an independent non-profit start-up, and now involves 200+ founders from 30+ universities across the UK and beyond.

ConceptionX is a pioneering venture training program and platform that helps PhD students commercialize their research and create investable deep tech startups. A venture builder running in parallel with a student's PhD degree. It is an innovation assembly line providing specialist-training, team building, mentoring by industry-professionals, engagement with client companies, to investment ready products. This *tech* programme has become a major catalyst for UK PhD student entrepreneurship and research impact; and is attracting industry professionals interested in mentoring and partnering with students and also for professionals seeking support in launching their own start-ups. Barclays Bank, Deloitte and XTX Ventures funded the launch of the programme.

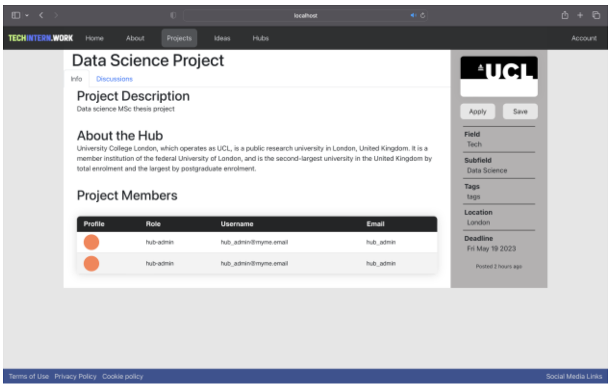

Figure 4: Digital Incubator TechIntern.Work

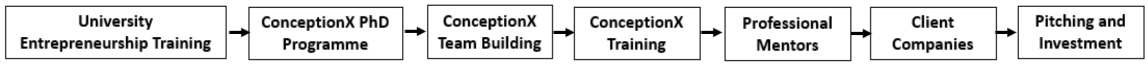

Figure 5: ConceptionX PhD 'Venture Scientist' Programme

ConceptionX focuses on PhD deep tech research; defined as fundamental breakthroughs in science and engineering that profoundly impact industries and people's lives. This forms a matrix of application areas/sectors *FinTech*/*InsureTech*, *HealthTech*, *PropTech*, *LawTech*, *EdTec*h, *FoodTech/AgriTech*, *BioTech;* and key technologies, such as data science. Now for the 200 PhD students, training and mentoring has moved online, so the programme has the potential of being delivered anywhere in the world, with global teams and targeting global markets.

5. Venture Scientists recommendations

The most gratifying aspects of the Venture Scientists paradigm is its simplicity and low risk, and that students are truly energized by pursuing novel deep tech research that can underpin a successful Tech Start-up.

This paper has argued that universities and governments should *institutionalize* support for Venture Scientists to create vibrant enterprise ecosystems. Based on experience from the UCL case study and successful programs in the US, I offer the following recommendations for the three main stakeholders of the Venture Scientist paradigm:

Universities

- **Enterprise research** – encouraging students and young professionals to see their research projects as precursors for pioneering products and tech start-ups.
- **Enterprise programs** – providing an integrated support program (cf., venture *assembly line*) from talent and ideas to research and start-up launch, involving tech entrepreneurship training, professional mentors/co-founders, clients, and investors. As exemplified by YCombinator.com and ConceptionX.org.
- **Academic promotion** – linking academic staff promotions to research impact and commercialization, and not just peer-reviewed academic publications.
- **Student IPR** – allow students to own the Intellectual Property Rights in their research, to encourage enterprise.
- **Upskilling** – support companies in innovation through upskilling their staff (e.g., part-time PhDs), student internships, and establishing intrapreneurship programs (e.g., Citigroup DX10).

Students & Young Professionals

- **Science/Engineering students** – provide science, technology, engineering, and mathematics (STEM) students with business skills and mentoring to commercialize their research. Start-ups are an excellent way to 'package' and deliver innovation to society.
- **Social Science students** – provide social sciences, humanities, and arts students with technical training (e.g., programming, data science) to build proof-of-concept (POC) and minimal-viable-product (MVP) products themselves. An example being the opportunities created by generative AI (e.g., ChatGPT) in the creative industries (CreaTech).
- **Professional development** – encouraging professionals to enhance their technical expertise through part-time technical PhDs and Masters' programs.

Government

- **Talent** – we need to equip all students with the necessary technical skills, such as programming and AI, for them to create POC/MVP products. In fact, arguably we are on the threshold of the AI (4^{th} Industrial) Revolution (Ref.).

- **PhD venture scholarships** – funding for aspiring students to pursue PhD research and commercialization in tandem.
- **Institutes of Technology** – pivotal for the Venture Scientists' paradigm is tech talent and in large numbers. A preeminent example is the highly successful Indian Institutes of Technology (IIT), a network of technical universities established by the Indian Government to drive economic development (Sohoni, 2012).

The 23 Indian Institutes of Technology (IITs) are ministry of Education Centrally Funded Technical Institutes located across India. They are governed by the Institutes of Technology Act, 1961, declaring them as Institutes of National Importance and laying down their powers, duties, and framework for governance as the country's premier institutions in the field of technology (ITTs, 2023).

6. Conclusions

In conclusion, governments are putting increasing pressure on universities to deliver research impact and contribute to national economic development. Government programs include a) expanding technical education; b) attracting foreign engineering and science 'talent'; and c) national R&D programs. However, we believe that Venture Scientist programs create vibrant enterprise ecosystems. More importantly it's an inspiring education paradigm, with students energized to pursue deep tech research and successful tech start-up.

7. Acknowledgements

Prof Sumi Helal and Dr Martin Schoernig are thanked for their significant feedback on this paper.

8. Further Reading

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