

**Building an Entrepreneurship Education Program in a Technology-Rich
Environment: Virginia Tech's Entrepreneurship Ecosystem**

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INTRODUCTION

In recent years, the entrepreneurship ecosystem at Virginia Tech has rapidly evolved into one of the leading global university entrepreneurship programs. Through an integrated mix of curricular and co-curricular programs and initiatives, Virginia Tech is leading the way in building a world-class entrepreneurship ecosystem throughout the Commonwealth of Virginia to serve the students, faculty and staff, Commonwealth citizens, and the entrepreneurship community at large. Building on the historic strengths as a pre-eminent STEM-focused institution, Virginia Tech's comprehensive ecosystem encompasses a unique blend of academic courses and programs, student experiential learning, and a broader support system to advance technology commercialization and entrepreneurship efforts.

Dedicated to entrepreneurship education excellence, Virginia Tech pushes the boundaries of knowledge acquisition and generation by taking a hands-on, transdisciplinary approach to prepare students to be leaders and problem-solvers. As the commonwealth's most comprehensive university and a leading research institution, Virginia Tech's entrepreneurship ecosystem spans multiple campuses across the Commonwealth and is anchored by our primary campus in Blacksburg, VA. These innovative and comprehensive efforts and demonstrated success have led to Virginia Tech's winning the National Model Program Award for entrepreneurship education from the United States Association for Small Business and Entrepreneurship in 2022.

BACKGROUND

Virginia Tech has a long history of entrepreneurship education. The Entrepreneurship, Innovation, and Technology (EIT) Undergraduate Major was launched in 2003 in the Department

of Management at the Pamplin College of Business. The interdisciplinary minor Entrepreneurship: New Venture Growth (ENVG) was started in 2014 by the Department of Management so that students majoring in any academic discipline outside of the Pamplin College of Business at Virginia Tech could benefit from the numerous entrepreneurship courses and a robust curriculum.

The Pamplin College also offers multiple entrepreneurship courses at the master's and Ph.D. levels. Courses focused on entrepreneurship and innovation are taught in the Evening MBA and Professional MBA programs, as well as in the highly ranked Master of Information Technology program, jointly taught by the faculty from the College of Business and College of Engineering. The Ph.D. in Business Administration program in the Department of Management offers courses in entrepreneurship and innovation for full-time students. The Executive Ph.D. program is offered to experienced executives seeking the advanced knowledge and skills needed to conduct high-quality research and take entrepreneurship courses.

The Apex Center for Entrepreneurs is housed in the Pamplin College of Business and offers experiential learning opportunities for any student at Virginia Tech, regardless of their major. The Center's programs are designed to empower students to translate their passions and academic training into new startups and initiatives. The Apex Center serves as a bridge between the business community and aspiring entrepreneurs and supports faculty research related to entrepreneurship, technology commercialization, and new venture formation and growth. Virginia Tech's entrepreneurship ecosystem is further enhanced by comprehensive programs on technology commercialization and entrepreneurship situated within Launch: The Center for New Ventures housed in the Office of the Vice President of Research and Innovation. Entrepreneurship faculty work closely with Launch staff and administrators to provide technology commercialization and

entrepreneurship training to support faculty spinouts, post-doc programs in technology entrepreneurship, and a variety of other training and support activities.

VT ENTREPRENEURSHIP EDUCATION ECOSYSTEM

Virginia Tech's entrepreneurship ecosystem is supported and enriched by a comprehensive approach to entrepreneurship education that spans Undergraduate, Graduate, and Doctoral programs to equip students with the knowledge, skills, and tools they need to be successful. At the Undergraduate level, our curricular strategy underscores the importance of a multi-faceted framework approach in Figure 1 to the entrepreneurship education ecosystem, which Virginia Tech exemplifies through its comprehensive programs and support mechanisms.

“Insert Figure 1 about Here”

Entrepreneurship Curriculum at Virginia Tech

As indicated in Figure 1, a strong entrepreneurship curriculum is at the core of Virginia Tech's entrepreneurship ecosystem. The primary educational objectives of the entrepreneurship curriculum are aimed at equipping students with the skills, frameworks, tools, and mindsets necessary for building leading-edge entrepreneurial ventures in broad technology-rich environments.

The Department of Management offers a Major, a Minor, and 15 courses on entrepreneurship and innovation. The department also has world-class faculty who conduct research in entrepreneurship and innovation, and these faculty shape the curricular works not just at the departmental level but also work closely with the Apex Center and other departments and colleges to support and enrich entrepreneurship education and experiential learning for students. Freshmen students can apply to be in the Innovate Living Learning Community (LLC), and a key part of being in Innovate is a mandatory Freshmen course that provides foundational knowledge

and skills in entrepreneurship. After early exposure, students can pursue an EIT major. The EIT Major is designed to equip the students with the knowledge and skills necessary to develop a new venture, engage in innovative pursuits in established companies, or pursue related careers that value entrepreneurial and innovation skills. The EIT is a four-year undergraduate major that enables students to discover their entrepreneurial potential (see Figure 2 for Curriculum Roadmap – EIT Program).

Students not interested in the EIT Major could do an interdisciplinary ENVG Minor. Students can also pursue the Innovation Minor housed in the College of Engineering. Students can also take entrepreneurship and related classes offered by various colleges. The Department of Hospitality and Tourism also offers entrepreneurship courses relevant to the hospitality and tourism sectors. A wide variety of programs are available outside the classroom for students to engage in entrepreneurial pursuits. Pamplin students can also practice their business planning, teamwork, and entrepreneurial skills with the semester-long project, which has generated over \$75,000 for charity and impacts about 1600 students per academic year.

In recent years, Virginia Tech has organized its institutional strategy to focus on four major [‘research frontiers’](#) – artificial intelligence, health and biomedical, cybersecurity and climate resilience, and quantum information technologies. Entrepreneurship faculty have contributed to the advancement of these initiatives through the development of cutting-edge curricula across the Undergraduate, Graduate, and Doctoral levels, including new courses in artificial intelligence and entrepreneurship, digital entrepreneurship, technology commercialization and entrepreneurship, sustainability, cybersecurity, quantum information technologies, among other integrated courses and activities.

“Insert Figure 2 about Here”

The program is open to any student at Virginia Tech every year. Currently, more than 1,500 students at Virginia Tech engage with entrepreneurship education in several important ways: (a) earn a major (the EIT Major), (b) earn a minor (the ENVG Minor or the Innovate Minor), or (c) take entrepreneurship courses without doing a major or minor. In addition, any student interested in entrepreneurship can participate in various co-curricular programs to complement their academic coursework and build important network ties with their peers, external stakeholders, and mentors.

Virginia Tech also offers multiple graduate courses at the MBA, Ph.D., and Executive Ph.D. levels. All students can discover new business venture opportunities and develop advanced skill sets to lead new entrepreneurial initiatives. The Master of Science in Business Administration with a concentration in Business Analytics and Master of Information Technology program, which is fully online, is designed to equip technology leaders with the interdisciplinary knowledge and skills needed to prosper in rapidly changing high-technology business environments. Ph.D. coursework is designed to train the next generation of entrepreneurship researchers and educators. Faculty members and students have published numerous articles in top entrepreneurship and management journals. They are leading the way in developing critical new streams of research at the intersection of artificial intelligence and entrepreneurship and related areas.

Entrepreneurial Activities and Co-Curricular Programs at Virginia Tech

Strong emphasis is placed on experiential learning, both in the classroom and outside the classroom, at Virginia Tech. The innovative and rigorous co-curricular complement various experiential learning programs through the Innovate Living Learning Community (LLC), the Apex Center for Entrepreneurs, and the E-Club programs.

The Innovate Living Learning Community (LLC) annually admits and educates 180+ students in entrepreneurship. The Apex Center for Entrepreneurs conducts many experiential learning programs, inspiring and empowering Virginia Tech students to turn their passion, purpose, and ideas into action. The Entrepreneur Club programs include E-Club Clubhouse, which has the power to transform VT startups—enabling student entrepreneurs to do their best work and Treks to innovative cities around the country.

Students participating in the EIT program will learn about starting new ventures in the classroom and practice those concepts directly to create their own and other businesses during experiential learning with the entrepreneurial activities and practices shown in Table 1:

“Insert Table 1 about Here”

Organizational Support and Resources at Virginia Tech

As a primary Research University in Virginia, Virginia Tech offers 280 undergraduate and graduate degree programs to more than 37,000 students and manages a research portfolio of \$591 million, placing it among the top universities in the US for research expenditures and the top university in the Commonwealth of Virginia.

Entrepreneurship classes are taught by Management faculty in the fall, spring, and summer semesters. A dozen core faculty members and 30+ supporting faculty instructors with core expertise in economics, human resources, finance, accounting, information science and systems, marketing, management, entrepreneurship, and startup experience are involved in teaching, coordinating, and running the courses. Virginia Tech entrepreneurship faculty have published papers in the very best entrepreneurship journals, and the size of the faculty and their research success continues to increase. As a result, Virginia Tech was a co-winner of the 2020 GCEC Award for Exemplary Entrepreneurship Research. This top award shows that Virginia Tech’s

entrepreneurship research and education are highly quality and impactful. Recent studies published in leading management and entrepreneurship journals have led the way in creating new streams of research at the intersection of artificial intelligence and entrepreneurship and innovation strategy. Entrepreneurship faculty continue to publish across other new and emerging streams of research as well, contributing to essential conversations on gender diversity and entrepreneurship, entrepreneurial action, crowdfunding, and resource mobilization, among numerous other topics.

The Commonwealth of Virginia and Virginia Tech have invested substantially in recent years to develop several new and exciting supporting initiatives and resources for the entrepreneurship education ecosystem on campus. In 2020, VT's announcement of a \$1 billion+ Innovation Campus in Northern Virginia was vital to a long-term strategy to build world-class research and educational programs in technology entrepreneurship and innovation in emerging areas such as artificial intelligence, blockchain, and cybersecurity. Many public-private partnerships among Virginia Tech, the Commonwealth of Virginia, high-growth startups, and leading global companies support these initiatives.

In March 2021, the Global Business and Analytics Complex broke ground, and the construction will be completed in three years. This \$250 million project relies on a percentage of private donations—an exciting opportunity for alumni to contribute to the future of Pamplin College of Business. This facility will allow Pamplin College to advance its mission to pursue excellence in providing a high-quality entrepreneurship education for a diverse student population and be recognized as a leading school of business in the US.

In May 2021, Boeing was named the first foundational partner of Virginia Tech Innovation Campus in Alexandria, Virginia. A \$50 million multi-year commitment from the company will provide an outstanding supporting opportunity for the students and the entrepreneurship programs

at VT. It will also help jump-start Virginia Tech's effort to create the most diverse graduate technology campus in the United States.

Community Outreach Connections at Virginia Tech

The entrepreneurship program supports the university's engagement mission by creating community partnerships and projects, offering professional programs and connections, and building collaborations to enrich discovery and learning — all with the overarching goal of improving the quality of entrepreneurship education within the commonwealth and worldwide.

The entrepreneurship education and programs have strong connections with alumni, boards, partner organizations, and other university affiliates. Moreover, we have engaged in global outreach connections. A long-standing relationship between the Pamplin College of Business at Virginia Tech and the School of Economics and Management at Xidian University (XDU) in Xi'an, China, has resulted in a unique collaborative program that has already welcomed two cohorts of students (about 100 students in each cohort). Plans are underway for the cohort size to increase to 120 per year. Through a memorandum of understanding with the Chinese Ministry of Education, the XDU-VT 3+1 program will train future leaders — particularly management students who have an interest in applying big data technology to entrepreneurship, innovation, and technology — to work cooperatively to lead world-class entrepreneurial ventures. Students will earn bachelor's degrees from both institutions: a BS in Business in Entrepreneurship, Innovation, and Technology from Virginia Tech and a Big Data Analytics degree from Xidian University. The program also showcases a unique model of partnership where students from the two countries will learn from each other as well as develop their professional network for their career growth and success.

Virginia Tech's entrepreneurship ecosystem includes a wide variety of programs and organizations, as summarized in Table 2. The Chinese students from Xidian University will be able to utilize all aspects of entrepreneurship connections and community outreach.

“Insert Table 2 about Here”

CONCLUSION

Virginia Tech's commitment to excellence in entrepreneurship education and its success in building a thriving entrepreneurship ecosystem is a unique model for academic institutions globally. Its multifaceted approach, which combines rigorous academic training with real-world experiential learning, aligns with the latest academic research on the efficacy of entrepreneurship education. Studies have shown that such an integrated approach effectively increases entrepreneurial attitudes, intentions, and, ultimately, the creation of new ventures. Furthermore, Virginia Tech's vibrant entrepreneurial ecosystem, replete with program curriculum, activities and practices, experiential learning, organizational resources support, and leadership vision, amplifies the impact of its educational initiatives, fostering a culture of innovation and business creation that extends beyond the campus.

Virginia Tech's comprehensive and robust curriculum, a wide variety of co-curricular programs, and support systems available within and outside the university for entrepreneurship and supportive policies align well to create a synergistic effect. Creating an entrepreneurship education ecosystem requires novel teaching, research, and business outreach approaches, critical for knowledge commercialization and engagement with entrepreneurial communities. Virginia Tech has proactively adopted novel approaches, setting a benchmark for other institutions.

In conclusion, Virginia Tech's commitment to excellence in entrepreneurship education and ecosystem is a unique and impactful model for entrepreneurship. The institution is committed to

maintaining and strengthening the high-quality, rigorous, comprehensive curriculum and the supporting ecosystem for students and student entrepreneurs to thrive. Virginia Tech thus serves as a model for other institutions aiming to achieve excellence in entrepreneurship education.

Table 1: Experiential Learning for VT Students from Entrepreneurial Activities and Practices

Entrepreneurial Activities & Practices	Description of Experiential Learning for VT Students
<i>Innovate Living-Learning Community</i>	Innovate LLC is a collaborative venture with support from the Pamplin College of Business, Student Affairs, and several departments and colleges across campus interested in engaging with students in the entrepreneurial experience. Innovate assists students in developing new business ideas, taking steps from ideation to creation, or furthering current ventures through the many programs and opportunities offered.
<i>Apex Center for Entrepreneurs</i>	The Apex Center for Entrepreneurs conducts non-curricular and co-curricular programs open to all Virginia Tech students. The program and Management Department cooperate with the Apex Center to provide premier resources for Virginia Tech students, alumni, and faculty innovators and entrepreneurs.
<i>Entrepreneurship Club</i>	The E-Club provides connections, knowledge, and inspiration for students to start a startup. Connections to other students, plus local and visiting entrepreneurs. Knowledge about entrepreneurship and business principles.
<i>The New Horizons Collaborative Program</i>	Since 2015, an evolving collaboration between faculty and staff at Virginia Tech with NASA personnel created the conditions for the emergence of The New Horizons Collaborative.
<i>Virginia Tech Entrepreneur Challenge</i>	The Virginia Tech Entrepreneur Challenge is a campus-wide student startup competition that brings together successful alumni entrepreneurs, industry partners, and students to showcase the best new ventures at Virginia Tech.
<i>Startup Hokies-Incubator</i>	The Startup Hokies-i incubator is designed to meet students in their entrepreneurship journey and supports student-led startups entering the beginning stages of building their companies. This program provides the best place for students to achieve their entrepreneurial goals.
<i>Venture Founders</i>	Student Venture Founders at Virginia Tech receive resources to match their passion. Our Founders are funded to travel to external competitions and placed in world-class programs to

	rapidly move their new ventures forward and tap into the affluent community of Hokie- entrepreneurs worldwide.
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Table 2: The Entrepreneurial Connections and Community Outreach at Virginia Tech

Entrepreneurial Connections	Description of Community Outreach at Virginia Tech
<i>Advisory Boards</i>	The Advisory Boards provide a structured environment for exchanging ideas with the alumni and industry leaders, foster interactions amongst the students and the Board members, and provide mentoring support to students. The Advisory Boards also offer suggestions on entrepreneurship curricula based on external trends, ensuring relevance and alignment with the job market.
<i>Creativity + Innovation Community</i>	Creativity + Innovation (C+I) is a university-level transdisciplinary initiative and a community of faculty and students with a vision and mission uniquely focused on curricular innovation. Collaborating with C+I partners, the programs explore novel approaches to delivering the Entrepreneurship transdisciplinary curriculum.
<i>Roanoke-Blacksburg Technology Council</i>	Promoting the growth of the region’s technology sector.
<i>Virginia Tech National Capital Region</i>	The community is dedicated to furthering the university’s education, research, and outreach in the Washington, DC metro area.
<i>Virginia Tech Office of Economic Development</i>	The Office of Economic Development is developing the capacity of communities and the university to support technology, talent, and entrepreneurship.
<i>Virginia Tech Intellectual Properties, Inc.</i>	Providing the opportunity to license technology development by Virginia Tech faculty, staff, and students.
<i>Northern Virginia Technology Council</i>	Connecting, growing, educating, and advocating for the innovative and entrepreneurial technology community in Northern Virginia and the greater region.
<i>VT-XDU Joint Program</i>	Students will do three years of coursework in China, and the courses taught there will be jointly taught by faculty from Virginia Tech and Xidian University. The students will attend Virginia Tech in their senior year for 12 months for intense coursework and experiential learning activities.