

It started with a need

A 20-year pedagogical journey into bioentrepreneurship

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The healthcare and life science sectors are facing growing societal challenges, increasing the need for innovation-oriented competencies. This paper illustrates two decades of pedagogical development in bioentrepreneurship at Karolinska Institutet (KI), a medical university. Using a narrative, sense-making-informed approach, data from courses and development projects were analysed to identify recurring patterns over time. Four insights emerged: 1) recognising entrepreneurship as a bridge between science and business, 2) realising the potential of entrepreneurship to broaden professional futures, 3) entrepreneurial learning gains depth through creating value with organisations, and 4) positioning education itself as outreach, and outreach as education. In conclusion, this pedagogical journey shows how bioentrepreneurship education evolves through ongoing negotiation, collaboration and contextual responsiveness, offering a model for integrating innovation capacity in specialised domains, like medicine and life science.

Introduction

Societies worldwide are facing major societal challenges linked to, among other things, climate change, demographic shifts, and a growing need for care. For healthcare, this means extensive adjustments that require technical and organisational changes as well as innovative change processes [1]. At the same time, companies in the life Sciences, such as those involved in drug development, medicine, and biotechnology, are facing a changing market where success is not only about growth, but also about ensuring long-term sustainability and managing increased regulatory requirements [2]. Here, universities have an important role to play in strengthening the innovation capacity, entrepreneurial awareness, and collaboration required for sustainable societal development [3].

Bioentrepreneurship is a knowledge and practice area that sits at the intersection of life science and entrepreneurship. In this paper, 'life science' refers to knowledge related to medicine and other natural science disciplines, and 'entrepreneurship' refers to a process of change through which new value is created [4]. A process where challenges and needs are turned into something new and useful, drawing on creativity, innovation, risk-taking, and flexibility [5]. By integrating these aspects, bioentrepreneurship has the potential to meet current and future societal challenges within healthcare-centred ecosystems. A central question is to establish bioentrepreneurship education as a legitimate and valuable part of the university's mission. This requires basic knowledge of what bioentrepreneurship is and how it can be practised, but also a broader understanding of why it is relevant and when it can create value.

The paper aims to present an illustration of two decades of pedagogical development in entrepreneurship within the context of a medical university. The paper describes how 'bioentrepreneurship' has evolved as an interdisciplinary educational field bridging life science and entrepreneurship. Rather than treating these interpretations as competing definitions, the paper deliberately traces how the meaning of bioentrepreneurship is enacted and expanded over time in response to educational and societal needs. It is grounded in our understanding of bioentrepreneurship not only as a commercial endeavour but as a broader mode of inquiry, learning, and societal contribution. By analysing the journey of bioentrepreneurship at Karolinska Institutet (KI), we seek to understand how awareness, attitudes and capabilities related to bioentrepreneurship can be cultivated through learning and education. In doing so, we contribute both practically and conceptually to the pedagogical literature on higher education, offering insights that may also be useful for educators in specialised and highly regulated domains, such as medicine and healthcare.

Method

This paper presents the development of bioentrepreneurship as an interdisciplinary educational field that bridges life sciences and entrepreneurship at a medical university. The methodological approach combines a narrative structure for organising the material with sensemaking as the analytical lens used to interpret it. The purpose is not to provide a strict chronological reconstruction, but to create a narrative that zooms in on significant insights to illustrate how particular initiatives, i.e. projects and courses, have shaped the pedagogical development. The narrative approach was chosen to capture development, contextual shifts, and educators’ experiences over time, which are difficult to access through more narrowly scoped analytical designs such as cross-sectional surveys or variable-centred analyses.

To identify relevant educational *initiatives*, an initial overview of courses, projects and related activities were conducted. Initiatives were included based on defined criteria. Only externally funded projects (i.e. projects supported through competitively awarded funding from national innovation agencies and European programmes) and courses that had been offered for at least three years were considered. Consequently, short, informal or undocumented initiatives were excluded from the analysis. The resulting set of initiatives is presented as a consolidated overview in Table 1.

Table 1. Consolidated overview of selected initiatives.

Type	Target group: number of initiatives	Focus
Curricular courses	BSc: 1	Introduction to the life science industry.
	MSc: 16	From broader introductions to entrepreneurship and commercialisation, to general courses in project management and communication, and specialised courses in product development, digital health, and marketing and sales in the life science sector.
	PhD: 8	Short specialised courses addressing themes such as intellectual property and assets, societal impact, health innovation, and science communication and engagement.
Extracurricular projects	Students (incl. doctoral): 6	Inspiration through role models, events, and early-stage innovation support.
	Faculty: 4	Entrepreneurial learning and implementation of practical change.
	Entrepreneurs: 2	‘Businessify’ science for growth.
	General public: 1	Citizens learning through engagement with students.

The subset of initiatives were then organised into groups reflecting recurring patterns and developments over time. Data was gathered from a range of project reports, course evaluations, curricula and strategic plans covering the period from 1998 to 2024. The analysis drew on a limited but purposefully selected set of documents, prioritising relevance and analytical richness over volume. In total, the material comprised some 50 documents. This selective scope naturally limits completeness but enables a focused analysis of recurring patterns.

The groups were analysed drawing on sensemaking theory [6, 7], where particular attention was paid to contextual triggers, responses, and the sensemaking of outcomes. Rather than aiming for exhaustiveness or causal explanation, the analysis focused on identifying recurring patterns and shifts in how bioentrepreneurship was understood and enacted over time, using sensemaking as an interpretive lens. This allowed us to understand concrete developments, such as how practical constraints (e.g. lack of premises) could trigger new forms of educational innovation (pop-up in public spaces), as sensemaking processes situated within the broader narrative of pedagogical evolution.

From this, four significant groups, referred to as insights, were identified, each reflecting how analytically derived clusters of initiatives contributed to the evolution of bioentrepreneurship education.

Findings

The findings of this paper are presented as four *insights*, each capturing how clusters of initiatives shaped the evolution of bioentrepreneurship education at KI over two decades. An overview of these insights is provided in Table 2, while the narrative below illustrates them through selected initiatives that exemplify key developments over time. The initiatives highlighted are illustrative rather than exhaustive and include examples that emerged through trial, adjustment, and, in some cases, unmet initial expectations.

Table 2. Four significant insights guiding the narrative.

Significant insights	
1	Recognising entrepreneurship as a bridge between science and business
2	Realising the potential of entrepreneurship to broaden professional futures
3	Entrepreneurial learning gains depth through creating value with organisations
4	Positioning education itself as outreach, and outreach as education

Recognising entrepreneurship as a bridge between science and business

In the late 1990s, a growing demand emerged for professionals in life sciences who could bridge the gap between science and business. At KI, a medical university, entrepreneurship was almost absent and perceived as distant from the core mission of educating healthcare professionals and conducting research for social benefit.

In 1998, KI joined the newly formed *Stockholm School of Entrepreneurship* (SSES) as one of the founding partners, alongside the *Royal Institute of Technology* and *Stockholm School of Economics*. Later, the *University of Arts Crafts and Design*, *Stockholm University* and the *Royal College of Music* joined. SSES became a shared platform for interdisciplinary entrepreneurship education, offering courses that allowed students to meet across disciplinary and professional boundaries. For KI, this marked an important moment, striving to position entrepreneurship as a bridge between science and business. A pioneering initiative was the course *Science Based Companies*, among the first of its kind in Sweden.

‘It’s the enthusiasm and excitement that surrounded the startup years, when the universities struggled to find ways to cooperate. [...] Seeing how diverse students would meet and slowly come to realise their unique contribution, meanwhile building respect for each other’s competencies, has been truly amazing.’ (Faculty interview, SSES Stories)

Over the following two decades, KI, through the *Unit for Bioentrepreneurship* (UBE), established in 2005, at the *Department of Learning, Informatics, Management and Ethics*, took a central role in shaping the SSES portfolio and pedagogy. A recurring trigger was the recognition that entrepreneurship at KI remained too narrowly tied to patentable innovations. In response, new courses were designed to address broader needs and possibilities. One illustrative example was *Idea to Service – Transforming Healthcare*, which encouraged students to question common notions of ‘business’ in healthcare, moving beyond associations with profit and capitalism towards ideas of improvement and change agency. The outcome was a broader educational scope for bioentrepreneurship and a concrete demonstration of how diversity in perspectives could drive innovation in healthcare.

‘There were students from different backgrounds in terms of educational, cultural personality and language differences, but it never acted as a barrier. In fact, it has been a good strength throughout the process as we have opinions from different perspectives, which is very much needed in this era and especially in the healthcare sector.’ (Course analysis, Idea to service course)

Realising the potential of entrepreneurship to broaden professional futures

The second insight shows how bioentrepreneurship education at KI was broadened beyond commercialisation and became embedded into existing programmes. This is illustrated through two initiatives: the project KIKI (Female innovators at KI), which expanded students' view on potential career paths through diverse role models, and *KI 2.0*, which used entrepreneurship as a lens to uncover and leverage hidden opportunities in curricula.

One initiative was the KIKI project, which addressed the lack of diverse role models in entrepreneurship. At the time, this lack of role models restricted how students envisioned their professional future. Instead of relying on stereotypical examples, such as well-known inventions e.g. the pacemaker, the project portrayed KI alums who had engaged in innovative or entrepreneurial activities within their profession. A series of printed folders was developed and distributed across 12 undergraduate programmes, reaching around 3,800 students. At the end of the project, students reported feeling inspired and motivated, describing how the role models challenged traditional career paths and helped them see new possibilities for their own professional futures.

'Excellent material about the three optometrists. I was moved and touched by the commitment they show. They inspire me to see possibilities and not to believe that I must be confined to a shop for the rest of my life just because I chose to become an optometrist.' (Anonymous student, Project evaluation)

Another initiative was *KI 2.0*, which sought to address entrepreneurship in undergraduate education in a more systematic way. Instead of relying on single efforts, it aimed to integrate entrepreneurship within study programmes. 11 out of 13 programmes joined the initiative, each forming a working group including faculty, professional representatives, students, and others. These groups took part in a series of co-creative workshops with a user-centred design approach to explore educational challenges and possibilities for renewal. Each group produced an action plan for their programme as the final output.

In these workshops, entrepreneurship was not only understood as 'starting a business' but was reframed as 'change agency', a way of driving improvement work and influencing healthcare organisations. The process also exposed unmet needs, such as the occupational therapy students' frustration that their curriculum seemed to prepare them only for elderly care. A physiotherapy alumnus recalled being told they 'could not expect to charge [money] for what they did'. These learnings from the project informed outcomes ranging from a shift in teachers' language and attitudes, as in dental hygiene, to new forms of teacher exchanges and competence development in dentistry.

‘Students have so many ideas, yet it can feel as if teachers ’flatten them out’ because students have to get through the programme. [...] There is doubt among students, precisely this sense of being ’flattened’, of wondering, ’is this really all there is?’ (Workshop 1, Working group A)

‘This solution is overarching. For us [teachers], working with rhetoric is important to change attitudes and approaches, both towards entrepreneurship and entrepreneurial learning, and towards learning more generally. How do we speak about ourselves? What do we pass on to the students?’ (Workshop 4, Working group B)

Entrepreneurial learning gains depth through creating value with organisations

During the mid-2000s, entrepreneurial learning gained momentum and was acknowledged in a global scholarship. The focus shifted from teaching only about or for entrepreneurship to creating experiential learning opportunities through value creation. This included a growing recognition that entrepreneurship could take place within existing organisations, and social forms of entrepreneurship attracted more attention.

One such initiative that illustrates this shift was the development of the *Bioentrepreneurship Team Projects* (BET) model. Inspired by the Keck Graduate Institute’s *Team Masters Project*, it represented an early step in this direction. Companies and organisations presented needs they lacked the resources to address, and interdisciplinary student teams were recruited to work on the needs. KI ensured scientific supervision, while external partners provided the context and challenges. This created immediate value on both sides. Companies gained new perspectives without the time-consuming task of organising the projects on their own. Students, on the other hand, were engaged in entrepreneurial problem-solving, and got networks and insights beyond what a traditional degree project could offer.

‘The BET project has been an exciting and, I believe, unusual form of thesis work. [...] It has not only helped us to produce a better thesis, but we have also gained insights and a foothold in the ’world outside’, which will undoubtedly be of benefit also after graduation.’ (Anonymous student, Testimonial)

Another initiative was the launch of a two-year *Master’s programme in bioentrepreneurship* (MBE) in 2008. The Bologna reforms created the structural opportunity to realise a long-standing ambition. Like BET, parts of the programme relied on collaboration with industry partners, and nearly half of its curricu-

lum consists of applied projects with external organisations. At the same time, it explicitly focused on corporate entrepreneurship and was grounded in the needs of the life science industry. Research-based companies were founded but struggled, since they lacked commercial awareness. Students were trained to combine their scientific expertise with regulatory, market, and strategic insights to drive change and create value both during the programme and in their subsequent professional roles.

‘I very much appreciated your curiosity, open-mindedness, eagerness to learn, and hard work. I have learnt a lot from this project as well, through all our conversations.’ (Anonymous company contact, Testimonial)

Positioning education itself as outreach, and outreach as education

At KI, facilities for creative learning were scarce. Traditional laboratories were well provided for, but spaces for collaborative or experimental learning were missing. This insight is illustrated through two initiatives of experimentation: the *Co-creative popup laboratory* (Co-up lab) and the *KI Innovation Day* (iDay).

So-called Co-up labs, i.e. mobile teaching spaces, were set up in libraries, museums and hospital entrances where students and the wider public could meet. By relocating learning activities to (semi) public spaces, conventional classroom boundaries were challenged and new opportunities for co-creation emerged. Even in busy, open spaces, students managed to sustain focus on learning tasks while also sparking conversations with those passing by, leading to unexpected insights and mutual benefits.

‘At SÖS [Södersjukhuset, a hospital in Stockholm], talking directly with patients and staff has given me a new perspective on how to approach a problem and how to think solution-wise. I feel motivated, encouraged and redefined.’ (Anonymous participant, Project evaluation)

Another initiative of experimentation was the iDay, a format created ‘by students for students’ but enabled through UBE. An externally funded project provided resources, continuity and organisational support. The student group took ownership of content design and communication. This structure combined the energy of a student-led initiative with the stability of institutional support. On the event day, the student team engaged peers to act as process coaches, creating strong peer-to-peer dynamics. Design Thinking framed the process, offering participants a systematic path to innovation while also weaving in patients’ perspectives by inviting them to share needs and experiences

‘It has been very good, especially that we got to interview real patients. It feels meaningful, with real problems that we can learn from and perhaps even find solutions to. I want to work in an innovative environment, and here I can gain inspiration by meeting other students and industry representatives.’ (Anonymous participant, Event evaluation)

Together, these initiatives demonstrate how education can serve as outreach, generating mutual value through interactions with broader communities.

Discussion

Over the past 20 years, bioentrepreneurship education at KI has evolved from a marginal experiment into a recognised and embedded part of the university’s everyday practices. What began as tentative steps to link science and business gradually expanded into broader conceptions of professional futures, deeper organisational collaborations, and more outreach-based formats. This trajectory reflects not linear but overlapping and dynamic events, shaped by contextual shifts, institutional learning, and ongoing sensemaking among educators. Notably, several of the initiatives described here emerged in response to earlier limitations, resistance, or unmet expectations, illustrating how pedagogical development unfolded through iterative adjustment rather than linear success.

The first insights, with the collaboration through SSES, highlight the strategic role of partnerships in building legitimacy and access to interdisciplinary expertise. This resonates with research on the ‘entrepreneurial university’, where external ecosystems enable internal change [8]. It also demonstrates how education can be anchored in established academic structures while adapting to new demands.

The second insight, realising the potential of entrepreneurship to broaden professional futures, illustrates how reframing entrepreneurship beyond commercialisation reshaped students’ professional imagination. This aligns with a broader discourse shift toward ‘entrepreneurial’ as an adaptive practice [9], emphasising personal agency, societal relevance, and career diversification. It also resonates with calls to embrace entrepreneurial diversity, valuing every day, and often invisible practices [10]. In healthcare contexts, this has been shown to involve professionals creatively adapting within complex systems, a perspective that can also enrich healthcare education [11].

The third insight, practice-based learning, underscores the value of co-creation with organisations. Research on value-creation pedagogy [12] shows that entrepreneurial learning deepens when students create value for others. In our case, student-organisation collaborations generate benefits for both sides: practical insights for partners and skill development for students. Such co-creation has been shown to increase impact when mutual benefits and new knowledge

are created [13].

The final insight, positioning education as outreach, signals a shift towards socially embedded learning. The Co-up lab and iDay illustrated how education can engage the public directly, aligning with research on the growing movement of patient and public involvement, in both research, innovation and education [14, 15]. Rather than separating education and outreach, these initiatives demonstrate models where knowledge circulates across institutional boundaries, creating both learning and social value.

Across all four insights, educators played dual roles as designers and participants in change. The reflexive nature of this paper highlights the potential of practice-based inquiry not only to document but to drive pedagogical innovation. While context-specific, the significant insights identified here may hold relevance for implementing entrepreneurship education in specialised environments.

The journey described here has unfolded gradually and through sustained effort rather than through rapid or singular moments of change. None of the initiatives alone would have been sufficient; instead, their development has been interconnected and built up over time, shaping bioentrepreneurship education at KI. Much of this work has taken place through continuous, often small-scale adjustments and everyday improvements, as educators have navigated questions of legitimacy, relevance and direction. Over time, these long-term efforts have shaped the bioentrepreneurship identity that has emerged at KI, particularly within the work carried out at UBE and LIME.

The journey described here has unfolded gradually and through sustained effort rather than through rapid or single changes. Much of this work has taken place through continuous, often small adjustments and everyday improvements, as educators have navigated questions of legitimacy, relevance, and direction. Over time, these efforts have contributed to shaping how bioentrepreneurship is understood, interpreted, and enacted in educational practice at KI, particularly through the work carried out at UBE and LIME.

Taken together, the paper illustrates a longitudinal shift: from initially legitimising entrepreneurship through partnerships, to broadening its meaning for students, embedding it in co-creation with organisations, and finally positioning it as part of the university's civic role. Seen in this light, bioentrepreneurship education has moved from the margins to a core arena where medicine, social science and society interact, even as the work remains an ongoing and unfinished process.

Conclusion

Altogether, the four significant insights illustrate how external drivers, internal curiosity, and strategic choices are interlinked in a non-linear way. They show that

embedding entrepreneurship in a medical university context is less about a single reform and more about an ongoing process of negotiation and renewal. This paper highlights the role of educators as both designers and active participants in change. It highlights the potential of education as a platform for fostering innovation and addressing broader societal needs. With sensemaking as a sensitising device, this pedagogical journey may inspire others to bridge medicine with the social sciences, humanities, and technology, expanding the horizons of professional education and ultimately contributing to better health for all.

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