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# *Mapping and Aligning Curricular and Extra-Curricular Doctoral Enterprise Education*



THE UNIVERSITY of EDINBURGH



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The project was carried out as a joint work between:

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**The University of Edinburgh Business School** (Fumi Kitagawa)

## Executive Summary

This project aims to map out and align curricular and extracurricular enterprise/entrepreneurship education for doctoral students. We conceptualise the doctoral enterprise education as a system consisting of two distinctive forms - *credit-bearing courses as part of the curriculum* and *extra-curricular activities and events* (e.g. bespoke training, business competitions, mentoring, business advice, incubators, accelerators). This report presents an overview of the existing curricular courses and extra-curricular resources available to doctoral/PhD students at the University of Edinburgh as a case study and identifies aspirations and challenges for PhD startup processes based on survey data and individual interviews.

### Key Lessons

There is a growing demand for a flexible enterprise education system at the PhD level and a supportive entrepreneurial ecosystem at the University of Edinburgh.

- In order to make an inclusive, effective and sustainable enterprise education system, we need to combine the strengths of both curricular and extra-curricular learning by aligning key stakeholders.
- A clear roadmap of enterprise education, resources and support is needed, informing and updating enterprise learning opportunities available for PhD students. The diverse needs of PhD students have to be taken into consideration e.g. those with families, and caring responsibilities.
- Enterprise education needs to satisfy the specific needs of PhD programmes and students. PhD students from different disciplinary backgrounds can also learn enterprise skills together – the university can help build inclusive and diverse PhD enterprise learning communities, across curricular and extra-curricular spaces. A short and flexible format is preferred by doctoral students. A general introductory enterprise training, as well as specialist advice and mentoring, is essential.
- The university needs to support and ensure sustainable entrepreneurial research culture. For instance, having entrepreneurs in residence and PhD enterprise mentors within Schools, and raising awareness of PhD supervisors about entrepreneurship processes would help support such a culture.
- Enterprise education and support can be better linked to career development and alumni network support. The entrepreneurial journey would encompass after graduation. Networks with alumni will help inspire current students, also.

### Recommendations

- **Enterprise educators** need to seek models of enterprise education for PhD students with a combined emphasis on both curricular and extracurricular resources. Specifically, a short and optional course on entrepreneurship with a focus on practical components and case studies may best suit the interest of most students.
- **Doctoral students**, who launch a startup, need to manage competing expectations under various types of pressure, including conducting research and meeting programme requirements as well as running a business. To gain practical knowledge to start up and run a business, actively engaging in enterprise-related extracurricular activities will help. These activities, as well as enterprise courses, are considered very helpful according to past participants and students.
- **University communities and wider stakeholders** can help build an inclusive PhD entrepreneurial ecosystem where different stakeholders, including PhD students, supervisors, Schools, and startup communities can work together. This will allow more PhD startups, which add creative value to both the economy and society.

# **1. Introduction**

Universities around the world are currently in the process of developing a closer engagement with businesses to support entrepreneurship environments and activities for students of all levels. These include entrepreneurship training programmes, entrepreneurship courses, mentoring programmes, accelerator/incubator programmes and business plan competitions. PhD students, equipped with expert knowledge in their respective specialist domains and the ability to engage in high-level research, are expected to play a significant role in entrepreneurial processes.

This report aims to present an overview of the existing curricular courses and extra-curricular resources available to PhD students at the University of Edinburgh as a case study,<sup>1</sup> identify aspirations and challenges of PhD startup processes based on survey data and individual interviews, and map out provisions and collaborative opportunities for future PhD enterprise education and training activities in a multi-disciplinary context at the University.

The report presents key findings from a joint research project between Edinburgh Innovations (EI) - the University of Edinburgh's commercialisation service - and the University of Edinburgh Business School (UEBS). It is supported by the Enterprise Educators UK (EEUK) under the Enterprise Education and Research Project Fund (EERPF) 2021/22. The main research was conducted between March and June 2022.

The next section outlines the aims and methodology of the research, followed by an overview of the current PhD enterprise education, the presentation of survey results and interview findings, and finishes with suggestions for future work and conclusion.

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<sup>1</sup> The University of Edinburgh has 37830 students in total, including 24695 undergraduate students, 9525 postgraduate (taught) and 3610 postgraduate (research) students, in the academic year 2020/21 (HESA, 2022).

## **2. Aims and Methodology**

The report has the following research objectives:

- 1) To capture existing enterprise education and training resources available to PhD students at the University of Edinburgh:
  - a. at the curriculum level, specifically on credit-bearing entrepreneurship courses embedded in different PhD programmes
  - b. at the extra-curricular level, specifically on entrepreneurship events and activities hosted by Edinburgh Innovations (EI)
- 2) To describe PhD students' experiences and attitudes toward entrepreneurship and enterprise education, based on survey data and individual interviews
- 3) To propose possible ways to get more PhD students involved in entrepreneurship and improve their experience with enterprise education in the future

This research employs a combination of qualitative and quantitative datasets to explore a range of enterprise and entrepreneurship provisions available at the University, and to reflect the diverse characteristics of PhD students, their motivations and entrepreneurship experiences, through surveys and semi-structured interviews. The study depicts the fast-evolving *university entrepreneurship ecosystem* with its *PhD enterprise education system* consisting of a) credit-bearing enterprise courses and b) extra-curricular bespoke activities and events.

### **3. An Overview of the Existing PhD Enterprise Education**

#### **System**

For students, learning about and experiencing enterprise while at university can lead to improved employability and the development of entrepreneurship skills. The business support activities and resources available at the university for enterprise activities, incubation and firm creation affect students' entrepreneurial interests and activities. In particular, entrepreneurship activities of PhD students often involve the creation of knowledge-intensive startups, which provides high-skilled jobs, supports the local economic structure, and helps to promote the university entrepreneurial ecosystem embedded in the surrounding economy. Given these impacts, the enterprise education system for PhD students becomes paramount in promoting PhD entrepreneurship on campus. The PhD enterprise education system consists of two distinctive forms - *credit-bearing courses as part of the curriculum* and *extra-curricular activities and events* (e.g., bespoke training, business competitions, mentoring, business advice, incubators, accelerators).

#### **3.1 Curricular Courses for PhD students at the University of Edinburgh**

A main approach to teaching enterprise on campus is through the creation of enterprise- or entrepreneurship-themed courses.<sup>2</sup>

While all taught credit-bearing courses available at the University are listed on the official course catalogue online,<sup>3</sup> identifying these enterprise- or entrepreneurship-themed courses is not so straightforward.

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<sup>2</sup> For a specific example showcasing the impact of entrepreneurship courses, see IDEA Entrepreneurship Centre from The University of Southern Denmark (SDU), which uses a centralized approach to integrate Entrepreneurship Education, including courses, across its six campuses and five faculties. See *Entrepreneurship Education at Universities: Learning from Twenty European Cases*.

<sup>3</sup> See [http://www.drps.ed.ac.uk/20-21/dpt/cx\\_sb\\_cmse.htm](http://www.drps.ed.ac.uk/20-21/dpt/cx_sb_cmse.htm) [last accessed 26/07/22]

There are 21 Schools across three Colleges at the University.<sup>4</sup> Individual Schools have their own PhD programmes and PhD students' course choices are conditioned by programme-specific requirements and policies at the School and programme level.

In order to gain a more granular understanding of the curricular enterprise courses available to PhD students, a closer examination was required across different Schools. Thus, an inquiry email was sent out to the postgraduate (or PhD) administration office of all 21 Schools at the University in March 2022 asking the following three questions:

- 1) Are there any enterprise courses that are available to the PhD students in your School if they are interested in launching a startup?
- 2) Do PhD students in your School have a *pre-determined* list of courses that they need to attend to satisfy the credit requirement of their PhD programme? Can they register for any enterprise course offered by other Schools (e.g., the University of Edinburgh Business School) during their study?
- 3) Has the office been approached previously by PhD students interested in taking a course on enterprise, or launching a startup during their study?

Based on the responses, most Schools currently do not run any enterprise courses within their PhD programme but there are appetites to create a short course for their students.<sup>5</sup>

There are a few notable exceptions. Currently, the University of Edinburgh Business School (UEBS) offers a series of courses on innovation and entrepreneurship that are open to postgraduate (MSc and PhD) students from different Schools, including an introductory course

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<sup>4</sup> See <https://www.ed.ac.uk/schools-departments/colleges-schools> [last accessed 26/07/22]

<sup>5</sup> Two Schools have expressed interests on the administration level to work with EI and potentially create a short course for their students.

on entrepreneurship offered to the first-year PhD students from Centres for Doctoral Training (CDTs).<sup>6</sup>

Given the traditionally research-based nature of the doctoral degrees, it appears that mandatory courses designated as part of the PhD programme course requirements are limited, while several Schools (e.g. the School of Economics, the Edinburgh Medical School, the School of Informatics, UEBS, and the School of Physics and Astronomy) responded saying that their students are required to select from a specific course list at least in Year 1 to 2 of their PhD programme. Most Schools indicated that PhD students can in theory enrol in enterprise courses offered by other Schools, provided that the request is first approved by their supervisor(s). However, only a handful of PhD students have explored this option, as partly evidenced by the fact that most administration offices are not aware of any PhD students making such requests previously. Some Schools host ‘entrepreneurs in residence’ who provide a short course or hands-on guidance on entrepreneurial activities.<sup>7</sup>

### Centres for Doctoral Training (CDTs)

Besides the single-School-operated traditional PhD programmes, a cohort-based PhD programmes model, such as Centre for Doctoral Training (CDT), Doctoral Training Centre (DTC), and Doctoral Training Partnership (DTP), is another approach often funded through the UK Research and Innovation (UKRI) to train doctoral students (hereafter, the term CDT is used to refer to these centres). These centres are formed by a group of research organizations- including universities and industry partners- combining research and industry experience to bring together diverse areas of expertise. PhD students in CDTs are trained in cohorts of

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<sup>6</sup> See Appendix for a list of enterprise courses offered to PhD students across different Schools.

<sup>7</sup> For instance, the School of Physics and Astronomy hosts an entrepreneur in residence, who ran an entrepreneurship course in 2022. The course was not part of any programme but was attended by a wide range of people- including PhD students.

varying sizes- typically partaking in cohort-wide training modules in a structured programme, allowing opportunities for collaboration.

In the academic year of 2021-22, there is a total of 34 CDT programmes offered at the University of Edinburgh. Given that each programme entails different organizations and structures, a separate inquiry email was sent out to the administration offices of these CDTs to find out whether the programme contains any course on enterprise or entrepreneurship available to students. The email responses and CDT programme websites suggest that 7 of the 34 CDTs contain enterprise courses of varying lengths and formats, ranging from a 2-day residential course on entrepreneurship and intellectual property<sup>8</sup> to a semester-long course on entrepreneurship and innovation.<sup>9</sup> The longer courses are typically offered by the Business Schools from the related universities (e.g., UEBS, Strathclyde Business School, Durham University Business School (DUBS)<sup>10</sup>); while the shorter courses are offered either by industrial partners (e.g., KKI Tech Commercialization<sup>11</sup>, Industrial Biology Innovation Centre<sup>12</sup>) or third-party training institutes (e.g., Electv).

Overall, there is a larger component of enterprise courses embedded in the PhD programmes offered by CDTs, compared with traditional PhD programmes. The CDTs seem to offer tailored enterprise courses aligned closely with the interests and needs of their programmes and students, in collaboration with specific partners and providers.

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<sup>8</sup>This course is part of NERC CDT in Satellite Data in Environmental Science (SENSE).

<sup>9</sup> For instance, the University of Edinburgh Business School (UEBS) has offered an online 'Innovation-driven Entrepreneurship' course since 2015, enrolling PhD students across several CDTs (e.g., Optical Medical Imaging (OPTIMA) CDT; CDT in Intelligent Sensing and Measurement; CDT in Applied Photonics; DTP in Precision Medicine).

<sup>10</sup> DUBS offers a mini-MBA course in Year 2 and 3 to students from EPSRC CDT in Soft Matter for Formulation and Industrial Innovation (SOFI<sup>2</sup>).

<sup>11</sup> KKI Tech Commercialization offers 'Innovation/Commercial Skills Training' for MRC DTP in Precision Medicine.

<sup>12</sup> The Industrial Biotechnology Innovation Centre offers 'The Practical Entrepreneur - Business Skills for the Future' and other workshops for BBSRC EASTBIO Doctoral Training Partnership.

### 3.2 Extra-Curricular Resources for PhD students at the University of Edinburgh

In addition to enterprise courses, extra-curricular activities serve as an important alternative to foster entrepreneurship culture – raise awareness and provide opportunities - outside the classroom environment. A positive relationship between extra-curricular activities and students' entrepreneurial intentions and outcomes is noted in recent studies.<sup>13</sup>

In this sub-section, we review the extra-curricular activities provided by Edinburgh Innovations (EI) Student Enterprise and PhD students' engagement with them. In the academic year 2021/22, EI hosted more than 290 student events of varying sizes, ranging from talks, workshops, and competitions, to 1-to-1 advisor meetings, startup accelerators, and award ceremonies recognizing emerging and established student entrepreneurs. As stated on EI's student enterprise website<sup>14</sup>, EI's services are “open to students and alumni from all schools, at all levels of study”, and “take your [student's] business and social enterprise from a raw idea right through launch and beyond”. In summary, EI services are open to all students and all types of startups at all possible stages of business development.

In the academic year 2021/22<sup>15</sup>, there were 59 individual engagements<sup>16</sup> with EI events involving PhD students, which occupies 6.2% of the individual engagements from all students who participated in these events in total.<sup>17</sup> A list of the most popular events attended by PhD students is presented below.

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<sup>13</sup> See Nguyen et al. (2021) Impact of Entrepreneurship Extracurricular Activities and Inspiration on Entrepreneurial Intention: Mediator and Moderator Effect; See Breznitz, S. M., & Zhang, Q. (2021). Entrepreneurship education and firm creation.

<sup>14</sup> <https://www.ed.ac.uk/edinburgh-innovations/for-students> [last accessed 26/07/22]

<sup>15</sup> This number is taken from 15<sup>th</sup> August 2021 to 25<sup>th</sup> June 2022.

<sup>16</sup> Engagements includes registrations and participations of EI events. We removed any duplicates where a PhD student has engaged with more than one event.

<sup>17</sup> All data are taken from the internal Salesforce server.

<b>Name of Event:</b>	<b>Description</b>	<b>Organizer(s):</b>	<b>No. of PhD Participants<sup>18</sup>:</b>
<b>DDE Venture Builder Incubator 2022</b>	A 4-month startup training programme for PhD students and academics.	Bayes Centre; Edinburgh Innovations	12
<b>Inspire Launch Grow Awards</b>	Celebration of outstanding student entrepreneurs in the academic year.	Edinburgh Innovations	7
<b>100 Startups Photoshoot</b>	Photoshoot celebrating 100 startups launched.	Edinburgh Innovations	7
<b>Creative Informatics</b>	A research and development project aiming to bring creative industries and tech sector together.	Creative Informatics; Edinburgh Innovations	6
<b>Introduction to Marketing</b>	Online workshop on marketing.	Edinburgh Innovations	4
<b>Startup Summer Accelerator 2022</b>	A 12-week learning and leadership programme to get student startups ready for investment.	Edinburgh Innovations; Santander Universities	4
<b>Open Innovation Challenge</b>	A programme opening students to patented technologies to help them build a successful startup.	Baynes Centre; Edinburgh Innovations	4

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<sup>18</sup> Data taken from Salesforce; actual participation number might be higher if participants' account is not recorded on Salesforce.

While most EI events are open to students at all levels of study, programmes that have a focus on PhD students and academic research, as well as potential funding, appeared to be more popular among PhD participants. The Venture Builder Incubator 2022 and Open Innovation Challenge, hosted by the Data-driven Entrepreneurship (DDE) programme, jointly organised by Edinburgh Innovations and the Data-Driven Innovation (DDI) initiative, are two examples that allow PhD students from different academic backgrounds to learn and work together towards developing their startup projects. The idea that some PhD students prefer to work alongside their academic peers is brought up during the individual interview sessions, which will be discussed in the later section.

Finally, Edinburgh Innovations also provides other forms of extra-curricular aid to PhD students, including physical support at the Student Enterprise Hub on two main campuses, visa support for PhD graduates, 1-to-1 meeting with business advisors, masterclasses, workshops and the online startup community platform. The new startup community platform allows students to connect and network with fellow entrepreneurs and potentially join an existing venture. There are currently 141 ventures on the site, with over 40+ PhD students registered on the platform.<sup>19</sup>

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<sup>19</sup> Data taken at the time of 13<sup>th</sup> June 2022.

## **4. Understanding Entrepreneurial Appetites of PhD Students**

Building on the overview of the enterprise education system at the University, in this section, we present the data collected from the PhD students enrolled at the University of Edinburgh. The findings highlight their entrepreneurial experiences, perceived challenges, and their perspectives on forms of enterprise education and training. We first examine and discuss findings from the online survey with over 80 PhD students across different Schools at the University of Edinburgh, followed by semi-structured individual interviews specifically targeting three types of PhD students with different entrepreneurship and training experiences. We included a small number of PhD supervisors in the semi-structured interviews to include their perspectives.

### **4.1 Enterprise Education Survey for University of Edinburgh PhD Students**

The online survey was open to the PhD community between 5<sup>th</sup> April to 15<sup>th</sup> May 2022 and contains 7 questions (see Appendix). It is designed to capture the perspectives of both ‘entrepreneur’ and ‘non-entrepreneur’ PhD students on existing enterprise courses and extra-curricular resources, as well as their views on embedding a PhD-level enterprise course into their programme.

A total of 82 responses were collected- including PhD students from all years of study across all Schools, with the exceptions of the School of Divinity, the School of Law, the School of Chemistry, and the Royal (Dick) School of Veterinary Studies. This includes students coming from traditional PhD programmes, as well as those from CDTs.

We first asked PhD students about their entrepreneurial experience:

- 34.6% of students have considered the idea of launching a startup

Students rated ‘networking’, ‘funding opportunities’, ‘1-to-1 Advisor Meeting’, and ‘extra-curricular activities’ as the most desired types of support they want to receive. Furthermore, workshops on specific topics such as intellectual property, accounting, and product designs are suggested in individual comments.

- Among all the PhD respondents, 8% are currently running a startup alongside their study.

This number is consistent with the national survey data in Italy presented in recent research.<sup>20</sup>

For those who have considered launching but are not currently engaging in a startup, there are some perceived constraints:

- 70% chose ‘time constraint during PhD programme’ as one of the reasons for the decision.

This is further reaffirmed in the interview sessions, as most PhD entrepreneurs expressed that they had to sacrifice their rest time and spare time to develop their startups.

- In addition, ‘financial uncertainties’ (55%), ‘lack of business experiences’ (50%), and ‘lack of business ideas’ (35%) are other main reasons that prevent PhD students from launching their startups.

All these reasons combined led some PhD students to either turn their heads away from the idea of launching their startup or delay the plan until they complete their studies. On a positive note, some of these challenges and obstacles, like uncertainties in business ideas or financial return, could potentially be minimized with the help of enterprise education and a developed entrepreneurial ecosystem on campus.

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<sup>20</sup> See *The Effect of the Academic Environment on PhD Entrepreneurship: New Insights from Survey Data* by Muscio et al. (2022).

Next, to gain an understanding of PhD students' awareness of existing resources, we asked our respondents about the organizations or programmes of support that they associate with starting up a business. Edinburgh Innovations (66.2%), Data-Driven Entrepreneurship (40%), and University of Edinburgh Business School (39%) are the top three organizations picked by students, followed by the students' own PhD School/Programme (29.9%). Interestingly, the result suggests that many PhD students do not necessarily associate startups with their School and that a group of them are aware of the entrepreneurial resources that exist outside of their programmes.

- In terms of curriculum, 8.6% of students have taken courses that focus on or include elements of entrepreneurship and/or enterprise during their PhD study.

This includes enterprise courses provided by Business School (e.g., Innovation-driven Entrepreneurship) and Medical School (e.g., Ethics and Regulatory Processes in Translating Innovation from Bench to Man) as part of some CDT programmes. All these students find the courses helpful and make them consider exploring enterprise and entrepreneurship further, with 40% choosing the option of 'absolute yes' when asked whether the courses were useful.

- For the majority of students who have not taken any entrepreneurship course, 58.8% expressed 'neutral' to 'high' interest in taking an enterprise course during their study.

The results show that PhD students benefit from enterprise courses and there is a considerable demand for enterprise courses among those who have not taken a course on the topic. More specifically, non-credit-bearing courses are preferred, with 62.9% of respondents rating 3 or above on a 5-point scale in terms of the level of desirability for this type of course. For credit-bearing courses, we observe a more divided opinion- with the majority of students rating either 1 point or 5 points on a 5-point scale in terms of the level of desirability. Based on the individual interviews, it became clear that PhD students are more concerned about the format and content

of these courses than whether they bear credits, as most students in traditional PhD programmes already have their credit requirements fulfilled from pre-determined courses or the final thesis.

- In terms of extra-curricular activities, 53.2% of respondents have heard about Edinburgh Innovations (EI) before.

Among the services that EI provides, ‘masterclasses and workshops’ (22%), ‘1-to-1 Meeting with Business Advisor’ (19.5%), and ‘Startup Community Platform’ (14.6%) are the options most frequented by PhD students.

#### **4.2 Enterprise Education Interview with Students and Staff**

To complement the survey findings and to gain a more contextualized PhD students’ views on enterprise education, we arranged semi-structured individual interviews with four groups of stakeholders between May and June 2022. The interviewees consist of the following four groups:

- 1) PhD student entrepreneurs,
- 2) PhD students who have engaged with Edinburgh Innovations but are not involved in a startup,
- 3) PhD students who have enrolled in credit-bearing enterprise courses during their studies, and
- 4) PhD supervisors and professional staff.

These interviews were conducted either in-person or online via zoom call.

For each of the four interviewee groups specific themes were pursued: for PhD student entrepreneurs, we focused on the interviewee’s journey of developing a startup alongside their PhD study; for PhD students who have engaged in extra-curricular activities only, we focused on the participation experience and the potential reasons that prevent the interviewee from taking the next step; for PhD students who have enrolled in credit-bearing enterprise courses,

we focused on the interviewee's perception towards these courses in retrospect and to examine whether the courses have any effect on his/her career development; finally, for PhD supervisors and professional service staff, we tried to gain some perspectives from a non-student group and to understand the potential obstacles and opportunities of having PhD students involved in entrepreneurship activities during the doctoral programme. We started every interview with a brief introduction of the research project and finished it with an opening-ended discussion on the possibility of a PhD-level enterprise course- specifically, on its opportunities, challenges, and the contents that it should embed to maximize its value to PhD students.

### PhD student entrepreneurs

#### a) The journey of creating a startup

The interviewed PhD student entrepreneurs' startups fall into one of the following categories:

a) the startup commercializes the PhD student's academic research, b) the startup utilizes at least one aspect of the PhD's expertise from his/her academic background, or c) the startup not related to the PhD topic. This ranges from one PhD student that integrated his research in data collection from low-cost sensors and the Internet of Things (IoT) into existing structural design processes in real-life, to another PhD student that uses her academic background in Business and Marketing to create a search engine for users.

While some PhD students may have had the entrepreneurial spirit from a young age, several of the PhD students interviewed admitted that they only started to consider creating a startup for the first time during their PhD study. This highlights the importance of raising awareness of entrepreneurial opportunities, instilling aspiration of creating a startup as a potential career pathway by incorporating a variety of forms of entrepreneurial components into the PhD programmes, either in curriculum or extra-curriculum and creating an entrepreneurial environment that encourages collaborations.

One student mentioned how she has decided to create a startup during her PhD:

“Before my PhD, I never really thought about it [creating a startup]. But things just came together as I became a real expert in a subject...which I know not many are experts to this degree, at least in Europe. And this really gives you the kind of window of opportunity and you just have to take action!”

Another student mentioned how she never wanted to do a startup until meeting her fellow PhD co-founder:

“..at first I never really saw myself as an entrepreneur because of the effort and the drive and motivation that you need to have. I would rather just be employed at first...until I came across my co-founder’s project. It was super exciting...but she said she couldn’t do it alone because of her PhD. And so I said to her, let’s do it together...and from then on, we never look back!”

#### b) Common obstacles on the startup journey

Time constraint is the most common obstacle faced by PhD student entrepreneurs. The pressure comes from the need to make consistent progress on both ends in the PhD research and the startup.

One student shared his current work schedule:

“PhD work currently takes up most of my time up to 10 pm, Monday to Sunday. Then I have about two hours between 10 pm to midnight to work on my startup.”

In addition, financial uncertainty, lack of business knowledge, and supervisor’s attitude are other obstacles.

PhD student entrepreneurs, specifically those that work in a startup outside of their research topic, face the risk of spreading themselves thin and jeopardizing their prospects of working in

academia. This leads to financial uncertainty since most startups cannot last more than two years. Based on the interviews, this group of PhD students are very passionate about their startup projects and prefer to work in the industry and not the academic world in the immediate future, if their startup does not work out.

Most PhD student entrepreneurs from the interviews come from a STEM background. These students did not necessarily possess the business or entrepreneurial knowledge needed to commercialize their research ideas initially. One student mentioned the difficulty of launching his startup in the beginning:

“I knew almost nothing about product design, pitching, funding, or marketing. It was a whole new body of knowledge, so I had to read books and go on Google...but also one learns the best by practising and doing, so I took part in a lot of EI [Edinburgh Innovations] events and competitions, and they definitely helped!”

c) Expectation management of PhD supervisors

Finally, another common obstacle is the management of the supervisor's expectations. In general, PhD supervisors expect their students to prioritize their research so i) the student can complete their PhD research on time, ii) the student can maximize their academic output during their PhD years, and iii) the student can continue to research in the respective academic field after their PhD. This creates potential tensions if the student proposes to run a startup alongside their study. The supervisors' attitude towards the startup is also largely determined by the supervisors' entrepreneurship experience and the relevance level of the startup to the students' research.

In one example where the student commercializes his PhD research, his supervisor has been on the startup team since the beginning as an advisor. As a result, the student benefited from his supervisor's support, as well as his previous enterprise experience in the respective field.

For other PhD entrepreneurs whose startup is not directly related to their research topic, a common approach is to keep the project from their supervisor until a later stage. These students believe that disclosing the project to their supervisor brings no benefits but problems to their startup; for example, it would be easy for the supervisor to attribute any lack of progress on the student's research to the startup, which results in additional pressure on the student's end.

On this topic, the PhD supervisors we interviewed offer their perspectives as to why they can be sceptical towards PhD students running startups alongside their studies. One supervisor commented on the nature of PhD research:

“We look for students with clear goals, preferably with a desire to stay in academia, when we recruit them...PhD research in most cases requires singular focus and tremendous commitment even for the most outstanding students. And PhD supervisors also invest a lot of their time and effort into the students' research. So, we want to make sure the student succeeds first in their research before they attempt to do anything else.”

Furthermore, another PhD supervisor believes that they can only be supportive and helpful to the student's startup if they possess relevant knowledge and enterprise experience. Overall, PhD supervisors could play a very important and positive role in the PhD enterprise ecosystem. For that to happen, a better alignment is required between the academic research culture and a fast-evolving university entrepreneurial ecosystem. For instance, the university can raise awareness of PhD supervisors by providing tailored information and training about entrepreneurial practices relevant to their field. PhD students may be allowed to have flexibility (e.g., extra time for PhD completion), which will enable them to carry out entrepreneurship activities.

### PhD students engaged in enterprise extra-curricular activities

#### a) Building a startup in the future

Most PhD students in this category expressed their desire to create or get involved in a startup after their study. They engage in extra-curricular events hosted by EI to learn more about entrepreneurship. They are either interested in commercializing their research or getting involved in a startup related to their study.

One interviewee explains his career prospects:

“I’d like to focus on completing my PhD research in Biological Sciences first because doing well in my research puts me in a good position regardless of what I choose to do... a startup is something that I have always wanted to do, but it will also depend on the job offers that I have. A startup in biological sciences normally requires a lot of funding to get started, the more experience I have working in the industry, the higher chance my startup will be successful in the future!”

#### b) EI events, workshops and networking opportunities

Introductory events, talks, and workshops are the most frequented EI activities for this group of PhD students. Some examples are ‘Find your startup idea’, ‘Introduction to Digital Marketing’, and ‘Inspire Launch Grow’ award ceremonies.

Unlike PhD student entrepreneurs who already launched their ventures, this group of PhD students focus on extra-curricular activities that introduce them to entrepreneurship concepts and specific knowledge, as well as networking opportunities, and not necessarily funding opportunities, training programmes, or competitions. Overall, they find EI events to be ‘helpful’ and ‘informative’. One student talked about how EI events helped him understand more about his career prospect:

“The extra-curricular events by EI are great resources... as a PhD student struggling to find time, the flexible format and diverse contents [of EI events] really allow me to learn something useful outside my study and make me consider starting my own business after PhD...I learned about pitching, digital marketing, and finding business ideas, all of these were new to me when I started my PhD.”

Numerous interviewees from this group expressed their interest in networking events, specifically networking opportunities with other PhD students. This is because PhD students ‘rarely have chances to meet PhD students from other fields of study’ and that ‘PhD students can better understand the schedule, research mindset and challenges faced by each other’. Many students recognize the importance of networking because it creates the opportunity for cross-disciplinary conversations, which possibly leads to collaborations where students from different disciplines join forces to tackle one problem.

#### c) Obstacles and opportunities

In addition to time management and commitment, PhD students taking part in extra-curricular events struggle to find the right business idea or to believe that their research has a real-life application.

A postgraduate administrative officer from the School of Mathematics shared her observations on the challenges that PhD students face:

“There are not many successful [startup] cases in the past and, most importantly, maths at the PhD level can be abstract so students do not know how to turn their research into a business...PhD students will need a bit of everything, including reassurances, successful cases in the past, and an active connection with other schools, to really believe that they can do it!”

The observation is generally applicable even to PhD students engaging in more applied and practical research. For example, most interviewees are not aware of any startup cases among

their peers and struggle to find any colleagues to talk about startup ideas. This limits the development of potential PhD startups as most students believe that they will need a co-founder to truly manage the workload that comes from creating a startup and conducting PhD research.

Overall, students are actively seeking a PhD community where they can network with students from other fields of study, chat about startup ideas, and even find their co-founders. Besides networking, this community should also include PhD entrepreneurs from and outside of the University to provide examples and suggestions to students that are interested in taking their first step. In terms of extra-curricular activities, hands-on projects (e.g., hackathons) and workshops (e.g., ‘3-day Startup’) could be actively promoted to PhD students, specifically those with a more theoretical background, to encourage any enterprise endeavours outside of their study field.

#### *PhD students enrolled in enterprise/entrepreneurship courses*

As discussed in the survey section, a small group of PhD students have enrolled in enterprise/entrepreneurship courses during their PhD programme. These students mainly come from CDT programmes where industry training opportunities and innovation courses are available as optional components.

##### a) Course content

A student from the EPSRC and MRC Centre for Doctoral Training in Optical Medical Imaging (OPTIMA),<sup>21</sup> a CDT hosted by the University of Edinburgh and the University of Strathclyde, has received 105-credit worth of enterprise education in 4 years, including ‘Innovation Driven Entrepreneurship’ (10 credits; UEBS), ‘Translational Study – Innovation and Entrepreneurship Masterclass’ (20 credits; UEBS), and ‘Entrepreneurship, Innovation and Commercialization

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<sup>21</sup> <https://www.optima-cdt.ac.uk/> [last accessed 26/07/22]

(10 credits; University of Strathclyde Business School). She commented on the content of the enterprise courses:

“I have learned a great deal about entrepreneurship from the courses overall, including presentation skills, teamwork, and just a general understanding of how to set up a business...specifically, I like how the commercialization element is tailored to my degree...it’s also nice that there’s no pressure from supervisors about which course we should choose! The only issue was that some of the content was quite repetitive from different courses. I’d also love to have taken a course on more technical topics like accounting.”

Another PhD student, from a different CDT, who has enrolled in the ‘Data, Innovation and Entrepreneurship’ course as an elective course of the PhD programme, expressed a similar wish for deep-level content on technical topics.

#### b) Useful-ness and Inspiration

All interviewees rated either 9 or 10 out of a 10-point scale on the usefulness of the enterprise courses in their programme, which is consistent with the survey findings. Even though none of the interviewees from this group is currently running a startup, all have started or continued taking part in extra-curricular activities related to entrepreneurship because of the courses and expressed that the courses have inspired them to consider the possibility of running a startup in the future.

One student commented on the importance of taking the courses during his study:

“...the [enterprise] courses should be praised for their layout and material. They are broad enough to give students an idea of entrepreneurship. From there on, it will be nice to have more follow-ups for those who are interested to take it further...overall, the courses made me consider the idea of commercializing my expertise in the future, something that I’ve never

thought of before. I have since taken part in a few EI [Edinburgh Innovations] talks to understand more!”

### PhD-level enterprise course

In the final part of the interviews, we listened to PhD students on the idea of a PhD-level course on enterprise and entrepreneurship. Specifically, whether a course of such nature should be embedded into PhD programmes across campus.

Most interviewees support the idea of a PhD-level enterprise course, while understanding that majority of the PhD students may prefer to prioritize their doctoral research project. As a result, such a course should be optional and preferably in a shorter format than a typical course spread over 10 weeks during the academic semester, allowing students the flexibility to explore and learn about entrepreneurship and enterprise alongside their research.

#### a) Content

According to some students, the course should be at an introductory level and contents should remain general; others are curious to explore more specific and practical topics through the course. This suggests that there is a demand for both general and specific content. In addition, the idea that the course would “incorporate some elements that are tailored to the student's field of study” was mentioned in multiple interviews- for example, an Engineering PhD student believes that he would benefit greatly from a course if it “embodies enterprise knowledge, like product design, specifically for engineering student”.

As for specific topics, ‘idea validation’, ‘pitching’, ‘digital marketing’, ‘audience targeting’, and ‘profit generation’ are among some of the topics that students would like to learn from the course. On the other hand, PhD student entrepreneurs, in general, would like to learn more on

specific topics like ‘IP regulation’ and ‘accounting’. There is no one-size-fits-all model for a PhD-level enterprise course. A way forward is to determine- possibly through more thorough market research- a suitable format, level of complexity and content that can enlighten the targeted group of PhD students that are interested in entrepreneurship.

Finally, most students expressed the wish of having some hands-on practical components in the course where they can “experience entrepreneurship first hand”. One PhD entrepreneur emphasized the importance of embedding the ‘product development’ concept and practice early on when he reflects on his startup journey, stating that it is crucial to the success of any startup and that the practice of building something is the “quickest and most efficient way of learning entrepreneurship.” In addition, students are also interested to learn from case-studies, referring to the idea of learning about entrepreneurship from existing entrepreneurs, and even placement opportunities to work in a startup. One student believes that:

“Nothing is more reassuring than knowing that there are successful entrepreneurs around me, and they probably have gained insights about the local ecosystem which will be immensely helpful to pass onto startups that are in an earlier stage”.

It is also worth mentioning that an enterprise course exclusive to PhD students will provide a “good networking opportunity to meet other researchers interested in entrepreneurship”, according to some interviewees, allowing students to work on developing a potential product with others from different fields of study.

## **5. Discussions and Suggestions for Future**

PhD students stand at an interface of different missions of the university – therefore they face a set of different expectations and pressures - including academic research culture, university’s teaching and learning frameworks, growing entrepreneurial business practices and changing societal values. Based on the findings from our surveys and interviews, this study shows that there is a growing demand for an inclusive and flexible enterprise education system at the PhD level and a supportive entrepreneurial ecosystem at the University of Edinburgh. Overall, the key message of this study is that an effective and sustainable enterprise education system would require the combined strengths of both curricular and extra-curricular learning by aligning key stakeholders.

### *Curriculum opportunities*

Drawing on the findings of the study, in terms of developing curriculum and courses, an ideal course on entrepreneurship may have the following characteristics:

- a) open to all PhD students offered as an optional component as part of the PhD programme,
- b) short and flexible in format to accommodate PhD students’ busy schedules and research demand,
- c) a wide coverage of levels starting from a general introductory course to entrepreneurship, to specific extensions on certain technical topics based on demands related to the specialist areas, and
- d) focused on practical ‘to-do’ components, case studies, and opportunities to observe and learn from existing PhD entrepreneurs.

In reality, the operational cost and number of students interested should also be considered.

As an exemplar, references can be made to the existing CDT model in terms of incorporating entrepreneurship components into the PhD degrees, all while they work on their research. These components may encompass a variety of forms including: short workshops (e.g., training day), industry placements, and collaborations between multiple institutions. Importantly, under this model, the cohort community provide students with transferable and practical skills, guidance on career options, access to industry partners, and networks with fellow researchers and entrepreneurially minded peers.

### *Extra-curricular opportunities*

As for extracurricular activities, Edinburgh-Innovations-hosted events would continue to be a crucial vehicle, complementary to curricular education. Besides hosting workshops and talks that cover a diverse range of topics, the flexible nature of EI events also allows a quicker and more spontaneous response to students' entrepreneurial demands. In addition, some EI events can also accommodate a bigger body of participants and embody more practical components (e.g., 3-Day Startup). These differences, compared to traditional courses, should be utilized to provide PhD students with a more immersive learning experience for entrepreneurship.

In recent years, there has been a rapid development of entrepreneurial and innovation initiatives at the University of Edinburgh, focusing on Data Driven Innovation with five DDI Hubs.<sup>22</sup> The aforementioned DDE Programmes have created an ecosystem of entrepreneurship support, from early-stage business creation to company growth and scale-up support, some of which specifically target PhD startup activities and have made tangible impacts (e.g., Venture Builder Incubator).<sup>23</sup>

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<sup>22</sup> <https://ddi.ac.uk/about-us/ddi-hubs/> [last accessed 26/07/22]

<sup>23</sup> See <https://edinburghdde.com/dde-programmes> [last accessed 26/07/22]

At the same time, it is important for EI to continue reaching out to the PhD community, as suggested by the survey data that 47% of survey-takers have not heard about EI. Overall, PhD students expressed their desire for more PhD-focused events and an inclusive PhD community, allowing students to network and collaborate with others from different fields of study. Building a sustainable PhD community should be a long-term goal which will prove to be rewarding- as it allows PhD students to truly utilize their expertise in their respective fields and potentially work on cross-disciplinary projects that will contribute to the ecosystem as a whole. Beyond the university, there are entrepreneurial funding competitions such as Scottish EDGE<sup>24</sup> and Converge Challenge.<sup>25</sup> External innovative commercialization competition schemes such as the Young Entrepreneurs Scheme (YES) <sup>26</sup> would be relevant for particular research fields and would help build networks of researchers and research students beyond the university.

#### *Aligning curricular and extra-curricular education*

In terms of designing and delivering enterprise education system across curricular and extra-curricular domains, one possibility is through the use of Student-Led, Individually-created Courses (SLICCs), developed at the University of Edinburgh.<sup>27</sup> SLICCs offer a flexible experiential reflective learning and assessment framework using e-portfolio for students from any discipline to gain academic credits. Experiences can range from co- and extra-curricular and fully defined by the student, to more fully defined by staff. Students develop their own set of personal and professional skills and attributes through this experience. During the process, students work closely with their SLICCs tutor to define the learning goal and reflect on the learning approach, experience, and development throughout the course. Besides summer NICE

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<sup>24</sup> <https://www.scottishedge.com/about-edge> [last accessed 26/07/22]

<sup>25</sup> <https://www.convergechallenge.com/> [last accessed 26/07/22]

<sup>26</sup> <http://www.yescompetitions.co.uk/> [last accessed 26/07/22]

<sup>27</sup> See <https://www.ed.ac.uk/sliccs> [last accessed 26/07/22]

SLICCs,<sup>28</sup> focused on intercultural competence and entrepreneurship, which are currently available to first- and second-year undergraduate students, cross-disciplinary and in-School SLICCs allow students, from pre-honours to integrated PhDs, to work across disciplinary boundaries and provide course structure and materials tailored to a specific activity. There are currently 17 postgraduate-level courses across the three Colleges that are based on the SLICCs framework. The activity-based, experiential, and reflective nature of the SLICCs framework would render it a great tool for PhD students to learn from business-based projects and experiences on entrepreneurship.<sup>29</sup> Nevertheless, there exist challenges and questions, like the assessment criteria, ownership and duration of the project, and ethos of the course (e.g., how long does it take to develop an entrepreneurial idea?; reflective learning vs feasibility/commercial success). Defining the right project and finding a tutor and examiner for the SLICC course is another challenge, which needs to be designed and implemented carefully.

### *Building the university entrepreneurial ecosystem and beyond*

There is a strong enterprise culture at the University of Edinburgh, and in the 2020/21 academic year, Edinburgh Innovations supported 102 startups and five spin-outs.<sup>30</sup> The university entrepreneurial ecosystem is not only about building tangible support programmes and providing commercialisation and business support. The university needs to ensure sustainable entrepreneurial research culture and build enterprise education systems. Along with the

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<sup>28</sup> <https://www.ed.ac.uk/global/go-abroad/nice-programme> [last accessed 26/07/22]

<sup>29</sup> In 2020, under the OPTIMA CDT, a new course was developed as a bespoke SLICC with an industry partner, through which 8 PhD students carried out industry based experiential projects in pairs. The student teams received continuous feedback from the industry collaborators, and delivered outcomes responding to the industry requirements. The reflective final report was assessed along with the students' project deliverables for a 20-credit course as part of the taught element of the PhD programme. See "Developing Partnerships: PhD students and Canon Medical" <https://edinburgh-innovations.ed.ac.uk/news/optima-canon-medical> [last accessed 26/07/22]

<sup>30</sup> SQW and Middlesex University (2022) *Comparing university-centred ecosystems in the UK and the rest of Europe*. Final report. See also, University of Edinburgh (2021) Startup milestone, 14 September 2021, <https://bulletin.ed.ac.uk/2021/09/14/startup-milestone/> [last accessed 26/07/22]

development of the PhD enterprise education system, the PhD research culture needs to evolve. As discussed above, there is an inherent tension between traditional academic research requirements and entrepreneurial business development during the PhD programme. As indicated by the interviewees, understanding and support from PhD supervisors could be a critical factor for a PhD entrepreneurship. It is important to include PhD supervisors in the enterprise education system as their attitudes contribute significantly to students' decisions on creating a startup. The university may consider providing some awareness-raising events and optional training opportunities related to entrepreneurship to PhD programme directors and supervisors to better understand the processes and challenges related to entrepreneurship and better facilitate a support system for student entrepreneurs at different stages of their journey. The Schools can also assign a PhD mentor with startup experience to students who may have an interest in entrepreneurship. In addition, the current mechanism that prioritizes research results (i.e., publication) can be adjusted to add focus on entrepreneurship and commercialization, by devising a system where both students and supervisors will be rewarded and credited for their effort if they turn a student's research into a startup with commercial and social values.

Beyond the University, students and researchers can tap into lively surrounding local entrepreneurial ecosystems - the Edinburgh City, Edinburgh and South East Scotland City Region and beyond. Moreover, they can cultivate and develop international connections and networks. PhD students can be key change agents who can connect the University and the multiple entrepreneurial ecosystems, and the university's enterprise education systems can open a door for these new opportunities.

## **6. Conclusion**

Over the last decades, PhD entrepreneurship has emerged to be a very potent economic and social force all around the globe. Google, Intel, VMware, and even the internet itself, are a few examples of what PhD students or graduates are capable of building. As a result, examining PhD enterprise education and ensuring an ecosystem that fosters entrepreneurship becomes a task of utmost importance.

This project aims to map out, align and integrate curricular and extracurricular enterprise/entrepreneurship education for PhD students as part of the emerging entrepreneurial ecosystems at the University of Edinburgh. We presented the current entrepreneurial courses and wider resources available to PhD students, and examined PhD students' individual perspectives on entrepreneurship opportunities and challenges through quantitative and qualitative datasets. In order to realise the value of university enterprise education systems for doctoral students, we propose a comprehensive format of support mechanisms, which would enhance the entrepreneurial learning culture as part of the PhD programme, accompanied by a series of activities which entail understanding of enterprise and entrepreneurship, and enhance employability of students.<sup>31</sup> This is indeed an overarching aim for promoting entrepreneurship on campus, across undergraduate and postgraduate students, researchers, academic and professional staff alike.

We conclude this report by identifying recommendations to the following key stakeholders of the doctoral enterprise education and PhD entrepreneurship.

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<sup>31</sup> In this context, the PhD enterprise education system can be aligned with the existing framework of "Enterprise lens on the Vitae Researcher Development Framework" (2011). <https://www.vitae.ac.uk/vitae-publications/rdf-related/enterprise-lens-on-the-vitae-researcher-development-framework-rdf-apr-2012.pdf> [last accessed 26/07/22]

To enterprise educators, a successful model for enterprise education for PhD students requires a combined emphasis on both curricular and extracurricular resources. It is important to expand the education to PhD students from all disciplines and conceive courses, with consideration to their format, contents, credit-bearing nature and duration, that satisfy the specific needs of PhD programmes and students. Specifically, a short and optional course on entrepreneurship with a focus on practical components and case studies may best suit the interest of most students.

To PhD students, launching and running a startup alongside research is possible but difficult in most cases. Hence, managing time and expectations become a crucial task during the journey. At the same time, almost all PhD entrepreneurs that have developed their startups to a later stage are actively engaged in enterprise-related extracurricular activities on campus. These activities, as well as enterprise courses, are reviewed to be very helpful according to past participants and students.

To university communities and wider stakeholders, building an inclusive PhD ecosystem where different stakeholders, including PhD students, supervisors, Schools, and startup institutions can work together - and not separately- will allow more creative and technical startups to be born from PhD students. Moving on, it is important to discuss and examine how different incentives can be aligned to encourage PhD students to be more actively involved in entrepreneurship and propel them forward on their startup journeys!

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## **8. Appendix**

### **8.1 Enterprise Education Survey for University of Edinburgh PhD Students**

#### **Privacy Statement (P1):**

Information about you: how we use it and with whom we share it.

Edinburgh Innovations only uses the personal data you have provided in order to carry out a survey for the purposes of determining how Edinburgh Innovations (EI) and University of Edinburgh Business School (UEBS) as part of the University of Edinburgh can best support our PhD students to realise opportunities in enterprise education and training. To do so, we are using Online Surveys as our survey platform. The information you provide will be used by the project team to map out the enterprise and entrepreneurship training provisions available across the University and beyond.

We will hold the personal data you provided us for 2 years. The survey will be anonymous unless you chose to leave your email in the final few questions of the survey.

We do not use profiling or automated decision-making processes.

If you have any questions, please contact Max at [max.chan@ei.ed.ac.uk](mailto:max.chan@ei.ed.ac.uk)

This Privacy Statement is continued at:

[www.edin.ac/privacy](http://www.edin.ac/privacy)

#### **Introduction to Survey (P2):**

Edinburgh Innovations (EI) and University of Edinburgh Business School (UEBS) are looking to engage students from across the university to identify the challenges doctoral researchers/students face when taking part in enterprise education and training. We also are looking to explore learning approaches and the possibilities of embedding enterprise contents into future curricula.

Edinburgh Innovations Student Enterprise team supports University of Edinburgh students, staff, and recent alumni to explore entrepreneurial opportunities and launch and grow their own enterprises. Last year we supported over 100 new student businesses to start, coming from across the university.

EI wishes to support the emerging vision for the Curriculum Transformation Programme which is a major and long-term initiative for the University, closely aligned to Strategy 2030. Between now and the end of Academic Year 2021/22 the focus will be on a series of institutional conversations to co-create a vision for the Edinburgh Graduate and the Edinburgh Curriculum.

We would highly appreciate your contribution in making this happen.

More information on Edinburgh Innovations and how we make ideas work for a better world can be found [here](#).

#### **Study Background (P3):**

Which school, institute, or department or you part of?

Which year of PhD studies are you in?

#### **Preferences and Experience in Enterprise/Entrepreneurship (P4):**

Have you considered launching a startup?

If yes, please rank the types of support you would like to see most from the university? (1 being the least desired and 5 being the most desired). [Credit-bearing Entrepreneurship Courses; Non-credit-bearing Entrepreneurship Courses; Extracurricular Workshops; Funding Opportunities; Networking and Contacts; 1-to-1 Meeting with a Business Advisor]

### **Preferences and Experience in Enterprise/Entrepreneurship (P5)**

Are you currently running a startup besides your study?

If not, would you like to share any particular reason(s) why you decided not to launch a business during your PhD? (Select all that apply.) [Time constraints during the PhD programme; Not interested in launching a startup anymore; Research supervisors do not support the idea; Financial uncertainties; Lack of business experiences; Other]

### **Programmes of Support (P6)**

Which organisations or programmes of support do you associate with starting up a business?

### **Enterprise/Entrepreneurship Curriculum (P7)**

Have you taken any courses that focus on or include elements of entrepreneurship and/or enterprise as part of your PhD study?

Did the course make you consider exploring enterprise and entrepreneurship further?

### **Awareness and Interview Opportunities (P8)**

Have you heard about Edinburgh Innovations (EI) before?

### **Remarks:**

We are now putting together a focus group of PhD Students to discuss enterprise and entrepreneurship on both curriculum and extra-curricular activities. If you'd like to be part of it, please leave your name and email address below. Please note if you would like to remain anonymous and still participate, we would be happy to set up one-to-one interviews.

## 8.2 Enterprise Education - Examples of Recent Enterprise Courses offered to PhD Students across the University

<b>A) Online Entrepreneurship Course for PhD students</b>	
<b>Subject:</b> Entrepreneurship, innovation <b>Year:</b> PGT/1 <sup>st</sup> year PhD <b>Course:</b> Innovation-driven Entrepreneurship	<b>Available to all PhD students across Schools (taught course elements)</b>
<b>Objective(s) or key message:</b> <ul style="list-style-type: none"> <li>This course teaches some of the generic and transferable skills required to become an 'entrepreneur' in the broadest sense. The course raises the student's awareness of the legal, business, managerial, creative, analytical and interpersonal skills relevant to setting up and running a new venture, or building an entrepreneurial opportunity within an organisation. The primary focus is on the development of an opportunity evaluation for a venture exploiting a novel idea or technology.</li> </ul>	
<b>Introduction :</b> <ul style="list-style-type: none"> <li>This introduction to entrepreneurship course provides an on-line enabled curriculum for students to explore entrepreneurship and innovation as a subject of study and as a practice. The course relies on multiple teaching methods including short lecture video presentations, interviews with individuals with a variety of venture experiences, and other audio-visual content and reading materials. As an on-line course, there are no physical lectures, while students will be engaged in a face-to-face group project with a component of making a creative presentation. Students are encouraged to participate and benefit from extra-curricular activities</li> </ul>	
<b>Activity:</b> <ul style="list-style-type: none"> <li>This course introduces students to the theory and practice of entrepreneurship. It focuses specifically on how and why some innovations are successfully commercialised, with particular emphasis on the role of the innovator-entrepreneur, with specific reference to science-driven innovation, which may be relevant to your programmes of study.</li> <li>Student Learning Experience This course utilises multiple learning modes, including: independent reading, primary research, video-lectures, group discussion, case studies, and exposure to practice.</li> <li>Syllabus             <ol style="list-style-type: none"> <li>1. Entrepreneurial motivation</li> <li>2. Entrepreneurial characteristics</li> <li>3. Contexts of entrepreneurial activity including social entrepreneurship</li> <li>4. Opportunity discovery</li> <li>5. Opportunity evaluation</li> <li>6. Acquiring resources</li> <li>7. Business models</li> <li>8. Entrepreneurial growth and strategies</li> <li>9. Entrepreneurial leadership, identities</li> <li>10. Exits and outcomes</li> </ol> </li> </ul>	
<b>Learner outcomes :</b> On completion of this course, the student will be able to: <ol style="list-style-type: none"> <li>1. Recognise and critically assess an opportunity in a market (and/or social) space relevant to their programme of study</li> <li>2. Critically analyse and consider different business situations where innovative and entrepreneurial opportunities are present or possible</li> <li>3. Research a business start-up opportunity and marketplace to evaluate the attractiveness and/or feasibility of an opportunity</li> <li>4. Communicate and demonstrate interpersonal skills</li> <li>5. Understand and apply the course concepts in the contexts of innovation, and venture creation and development</li> </ol>	

## B) Face-to Face Entrepreneurship/Translation Course for PhD students

**Subject:** Entrepreneurship, innovation  
**Year:** PGR/2<sup>nd</sup> year PhD  
**Course:** Translational Study - Innovation and Entrepreneurship Masterclass

(taught course elements for OPTIMA CDT and other PhD programmes)

### Objective(s) or key message:

The Translational Study - Innovation and Entrepreneurship Masterclass is a student-led, independent study course designed to promote student exposure to the challenges and opportunities associated with translating healthcare innovation into a market context. The course builds on the outcomes of the OPTIMA courses (i.e. Grand Challenge, Innovation-Driven Entrepreneurship (IDE), and Ethics and Regulatory Processes in Translating Innovation from Bench to Man), or other background experience considered relevant. Students will work in small teams to examine a specific innovation of healthcare technology. The projects will be related to actual scientific research results and will address real world considerations in commercialisation, drawing on guidance and input from leading edge researchers, entrepreneurs and other professionals, including colleagues from the Business School.

### Introduction:

The course is designed as an integral part of the PhD with Integrated Studies offered by the OPTIMA CDT. It will also be able to accommodate other researchers/research students from the business school and other schools from the university with prior agreement. The current course builds on the overall programme of OPTIMA activity, in particular the Grand Challenge; the Innovation Driven Entrepreneurship course in year 1, and Ethics and Regulatory Processes in Translating Innovation from Bench to Man in year 2. In addition, it sensitises the students to the range of real world issues involved in commercialisation of healthcare technology and thus prepares them for further optional courses in innovation and entrepreneurship in year 3 (and 4).

### Activity:

The course is organised in three phases: 1) ideation, 2) development research, and 3) entry evaluation.

- Phase 1, ideation, is a 3 week activity in which the teams explore a limited set of innovations relevant to their research studies. Teams will be allocated a specific case drawn from experience within the OPTIMA network and will assess how this compares with competing or other similar innovations. At the end of this phase teams will present their findings and will be assessed on the content and delivery of their presentations.
- In Phase 2, development research, the teams will examine what primary research on the industry and market relevant to the anticipated product or process has been carried out. Students will be encouraged to engage with industry participants to better understand customer needs, product development requirements, manufacturing parameters, and distribution and support processes. This phase will occupy 4 weeks, depending on the complexity of the particular case examined. At the end of this phase teams will submit a draft report focussing on issues of market feasibility for formative feedback.
- Phase 3, entry evaluation, is a 3 week activity in which teams explore the resources and processes necessary to bring the particular innovation to market. At the end of the phase, teams will submit a formal written report presenting their analysis, including a critical appraisal of the commercialization path adopted. Teams will be assessed on the content and delivery of their report. In addition, teams will present their findings to a panel including industry representatives.

Each phase will be introduced by a formal overview lecture, with further lectures and seminars covering key issues and supported by supervisory meetings each week. The experience and learnings acquired from the course will be consolidated through the submission of an individual Reflection on Learning paper, supported by a personal learning log, which the students will maintain throughout the course activities.

**Learner outcomes :**

On completion of this course, the student will be able to:

1. Work effectively in teams and understand the various roles that individuals can play in teams, including leadership and taking responsibility for individual contributions.
2. Understand the specific challenges associated with translating a research-driven innovation into a commercial context, and develop a critical appreciation about how the available theories, principles and concepts in the field of innovation and entrepreneurship can throw light on the practical issues confronted.
3. Explain the imperatives for primary research on market needs and new product requirements, using an appropriate range of specialised techniques and skills reflecting current best practice.
4. Describe the general stages of technology commercialization, informed by developments at the forefront of academic and industry experience, including a critical awareness of different organizational forms and resource requirements, organizational forms and resource requirements.
5. Communicate the results of market and industry research using appropriate methods to both scientific and business audiences and critically assess the potential commercial value of a novel innovation for a specific market need, taking account of the need to make informed and ethically sound judgements in the face of inconsistent and incomplete information.

**C) Online Enterprise/Business Course for PhD students**

**Subject:** Entrepreneurship, innovation

**Year:** PGR/ 3<sup>rd</sup> year PhD

**Course:** Course: Business School Postgraduate Student-Led Individually Created Course (SLICC) 2020/2021

(taught course elements, option for the OPTIMA CDT PhD students)

**Objective(s) or key message:**

This Student-Led Individually Created Course (SLICC) for Postgraduate students is an option course developed within the University-wide framework for self-designed experiential learning. Students will direct their own learning using the Student-Led Individually Created Course (SLICC) approach. They will plan, propose, carry out, reflect on and evaluate a piece of work undertaken within their own context. The SLICC is available to Postgraduate students whose programme of study allows them to undertake a SLICC.

**Introduction:**

The course is designed as an integral part of the PhD with Integrated Studies offered by the OPTIMA CDT. It will also be able to accommodate other researchers/research students from the business school and other schools from the university with prior agreement. The current course builds on the overall programme of OPTIMA activity, in particular the Grand Challenge; the Innovation Driven Entrepreneurship course in year 1, and Ethics and Regulatory Processes in Translating Innovation from Bench to Man in year 2. In addition, it sensitises the students to the range of real world issues involved in commercialisation of healthcare technology and thus prepares them for further optional courses in innovation and entrepreneurship in year 3 (and 4).

**Activity:**

The student is responsible for developing and undertaking a project which enables them to achieve and demonstrate achievement of the Learning Outcomes, framed within the subject area of their Postgraduate programme, and aligning with their programme-level learning objectives.

Undertaking a SLICC enables the student to create and shape a learning experience which is unique to them. The student develops an e-portfolio to provide evidence of their learning. This Level 11 course requires students to demonstrate the development of their skills and understanding in terms of critical analysis, application, reflection, recognising and developing skills and ways of thinking, and evaluation within a specific context of their learning experience.

This course will also enable students to demonstrate their ability to exercise autonomy and initiative at a professional level in their field of study.

**Learner outcomes :**

A SLICC is assessed via three key components, a self-reflective report, an agreed portfolio of outputs/deliverables and a formative self-assessment.

- Self-critical Final Reflective Report (100% weighting): The reflective report is the key component of the assessment. The student is expected to document and demonstrate active self-critical reflection and responses to their learning throughout the experience. It is essential that the student's report is linked to, and draws upon, their e-portfolio of evidence of learning. Maximum word limit is 3,000 words.
- E-portfolio of evidence: At the proposal approval stage for the SLICC, the Course organiser will discuss and agree with the student what outputs and information need to be created, collated and submitted in their portfolio. This e-portfolio will support and provide evidence of the student's learning and development of skills through undertaking the SLICC. The portfolio should be constructed throughout the duration of the learning experience, demonstrating evolution, iteration and progress over-time. For instance, E-portfolio may include a regular reflective blog diary. It may contain other evidence, which may take many forms including, for example, photographs, documents, reports, feedback, video, and podcasts.
- Formative Self-Assessment: An important component of the final submission is for the student to demonstrate their understanding of their achievements through graded self-assessment. In undertaking self-assessment, students are required to demonstrate the alignment of the grades that they give for each learning outcome to the justification for them, and where this is evidenced within their e-portfolio.

Source: Adopted from  
The University of Edinburgh, Degree Regulations and Programmes of Study