



Supporting the entrepreneurial potential of higher education

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1 Milan Polytechnic University, Italy: Experience-oriented entrepreneurship education

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Abstract



Milan Polytechnic University (Polimi) is the largest Italian technical university. Its primary purpose is to provide students with solid technical competences. Recent studies on student entrepreneurship at Polimi have shown that the technical competences of Polimi alumni frequently generate new business ideas that often lead to start-ups. Thus, the University's School of Management has devoted growing attention to teaching students how to commercially exploit business opportunities by starting new ventures. For this purpose, it has developed an "experience-oriented approach" for its curriculum. This approach makes students test themselves in real-world settings through the development of a business model for an entrepreneurial idea. The approach is based on lectures from professors, guest lectures from practitioners, assisted work groups with mentor assignments as well as selecting and developing business ideas. Both undergraduate and postgraduate students were found to value this experienced-based approach. Besides its curricular offer, Polimi performs extra-curricular entrepreneurship education activities through its business incubator, PoliHub. PoliHub staff is marginally involved in curricular courses for Polimi students and provides actual and prospective incubated entrepreneurs with education opportunities. Moreover, it offers a number of non-education services to incubated companies. The Polimi case suggests that an experience-oriented approach should be tailored to the characteristics of the target group of students. The approach may easily be applied at any university where students develop technical competences or are trained to enter creative industries.

Case study fact sheet

■ Full name of the university, location:	Milan Polytechnic University, located in Milan, Italy
■ Legal status:	Public
■ Location:	Two large campuses in Milan (Leonardo and Bovisa) and five smaller campus in Como, Cremona, Lecco, Mantova, Piacenza
■ Year of foundation:	1863
■ Number of students:	38,227 students enrolled in the 2013-2014 academic year (most recent available datum)
■ Number of employees:	Teaching and research staff: 1,313 (at 31/12/2013) Administrative staff: 1,177 (at 31/12/2013)
■ Budget in most recent financial year:	Turnover 2012: 550 billion Euros
■ Academic profile:	Polimi is one of the largest technical universities in Europe. In recent years it climbed QS World University Rankings, reaching 31 st place in the world in the subject of Engineering and Technology
■ Entrepreneurial profile:	Milan Polytechnic University, through its School of Management, is placing growing emphasis on entrepreneurial education through increasing the number of elective entrepreneurship courses at both undergraduate and postgraduate levels and through the extra-curricular activities offered by its incubator, PoliHub.
■ Activities focused in this case study:	Elective course "High-Tech Entrepreneurship" – MSc level ("High-Tech Entrepreneurship" can be selected as a supplementary course by Polimi PhD students in the engineering field); entrepreneurship stream in the Executive MBA and "Start-up Programme" – postgraduate level.
■ Case contact person(s):	Gatekeeper: Evila Piva, Associate Professor at Polimi

Information included in this case study is from end of year 2014 unless stated differently.



1.1 The university's entrepreneurship education profile

1.1.1 The university's overall approach to entrepreneurship education

Milan Polytechnic University (Polimi) is the largest polytechnic university in Italy. It began developing its entrepreneurship education (EE) in 2001, when the University incubator was created. Polimi incubator staff immediately started providing incubated university students, alumni and researchers with both basic skills and competences in the entrepreneurship field as well as services to help developing incubated companies. These offers were extra-curricular.

Since 2008, Polimi – more precisely, Polimi's School of Management – has placed growing emphasis on EE. The School of Management is made up of Polimi's Department of Management, Economics and Industrial Engineering as well as MIP Politecnico di Milano, Polimi's business school which is formally a non-for-profit consortium limited company.¹ MIP is a consortium between the University, Assolombarda (the entrepreneurial Association of firms located in the region of Lombardy) and a number of primary multinational corporations (e.g., FIAT, IBM Italy, Vodafone). MIP has developed a curricular offer of entrepreneurship courses. At the moment (status: end-2014), there are a few entrepreneurship courses at both undergraduate and postgraduate levels and none of them is mandatory. However, the offer of elective courses in the entrepreneurship area is increasing. Polimi's specific approach in EE is experience-oriented.

Since 2012, Polimi's extra-curricular activities have also evolved significantly. The University incubator stopped being exclusively focused on Polimi students, alumni and researchers. It became PoliHub, a start-up district more and more focused on providing non-Polimi entrepreneurs who have innovative technology-based business ideas with the education and support they needed to develop their entrepreneurial projects.

1.1.2 Leadership and governance

Importance of government strategies

Both the Municipality of Milan and the Chamber of Commerce of Milan are highly committed to stimulating local development by fostering start-up creation and growth. The importance of support to entrepreneurship in the strategies of local public bodies has been crucial for the development of Polimi's extra-curricular activities. Since 2001, Polimi's incubator has taken advantage of financial support from the Municipality of Milan.

On the other hand, EE curricular offers at Polimi have never been driven or supported by any governmental strategies or programmes.

Importance of entrepreneurship in the university's strategy

At the moment, entrepreneurship plays only a minor role in Polimi's strategy. As one of the University's objectives is to support technology transfer activities, since 2001 Polimi has invested in the development of the incubator's extra-curricular activities. Conversely, EE curricular activities have no role in Polimi's strategy.

However, entrepreneurship has started playing an important role in the strategy of Polimi's business school MIP. In 2013 and 2014, in order to differentiate its offering from

¹ See <http://www.mip.polimi.it/mip/en/globals/mip.html>.



its main competitor, SDA Bocconi School of Management, MIP has started proposing itself as a business school able to train not only managers but also entrepreneurs. Hence, the number of entrepreneurship courses offered to MIP students has multiplied.

Extent of high level commitment to implementing entrepreneurship education

The commitment of past Polimi Rectors, Vice-Rectors and Deans of the different Schools in developing a solid offer of entrepreneurship courses has been limited. Conversely, the current Rector and the Deans of some Schools – in particular, the Dean of the School of Industrial and Information Engineering – are open to proposals from research groups active in the field of entrepreneurship. One of these proposals suggests the inclusion of one elective EE course in any MSc programme in the engineering field in the upcoming academic years. Furthermore, in previous years Polimi officers paid greater attention to supporting entrepreneurship among students and faculty members by devoting huge resources to the university incubator.

MIP high level officers show greater commitment to extend the business school's EE offer than Polimi officers do. As the MIP business school is a subsidiary participating in but not controlled by Polimi, MIP's strategy is influenced by the strategy of the University as a whole, but it is not an emanation of the latter. In recent years, the high level officers of MIP have constantly struggled to expand the school's education offer in the entrepreneurship area.

Level of faculties' and units' autonomy to act

At the University level, single researchers and research groups are free to propose courses, which can be included in different educational offers.. At the MIP business school level, faculty members are strongly encouraged to suggest courses for inclusion. At both levels, the effective inclusion of new courses is to be discussed and approved by the Programme Board. However, the probability that any new course is included in the educational offer of any programme is much more likely at the business school level as compared to the University level. This is due to the fact that the maximum number of credits that can be offered by the University is limited. Conversely, at the MIP business school, there is no constraint.

At both levels, the faculty members doing research in the entrepreneurship area are free to choose the contents and teaching methods of entrepreneurship courses.

Organisational implementation

At Polimi, EE initiatives are organised in a decentralised manner by the researchers active in the entrepreneurship field. These researchers are all located in the School of Management, i.e. the entity grouping Polimi's Department of Management, Economics and Industrial Engineering as well as the MIP business school.

University's importance for driving entrepreneurship in its environment

Polimi is very important for driving the creation of new businesses in the Province of Milan and the Lombardy region. Polimi contributes both technical and business competences for business ventures. For further details see the chapter about impact at the end of this case study.



1.1.3 Resources: people and financial capacity

Human resources for entrepreneurship education

EE initiatives at Polimi involve both academics and practitioners. The teachers of entrepreneurship courses are members of the School of Management faculty. Practitioners are usually involved in the courses for providing examples from real business life.

Financial resources for entrepreneurship education

Since EE offers are as yet limited, Polimi, at both University and business school levels, neither has nor needs a dedicated budget for EE.

1.2 Entrepreneurship in curricula and teaching

1.2.1 Overview about curricular offers in EE

Current offers

Polimi has three major offers in curricular entrepreneurship education: a course in “High-Tech Entrepreneurship”, an “Entrepreneurship Stream” at Executive MBA level, and a “Start-up Programme” within the MIP’s Entrepreneurship Academy offer. The Entrepreneurship Academy is a label under which MIP offers continuous education in entrepreneurship. These three curricular EE offers were selected for analysis in this case study because of their relatively large number of hours of lectures and case study discussion. The Start-up Programme does not offer academic degrees but certificates of participation.

There is also a “Business Planning” course” which is aimed at teaching participants how to write a business plan. The course is not providing any additional competences in the entrepreneurship field. Hence it is less interesting than the remaining initiatives described in this case study.

Exhibit 1-1 presents all curricular offers in entrepreneurship education at Polimi. See also the annex for a more detailed description of the three offers.

Exhibit 1-1: Overview about curricular offers in entrepreneurship education at Polimi

No.	Name	Objectives	Target group	Offered since	No. of participants in the last edition
1	“High-Tech Entrepreneurship” course	Providing students with knowledge, tools, and experiences that may help them to anticipate the problems likely to be encountered when establishing a new venture and to identify sources of information that can be used to find solutions to these problems.	Formally, students enrolled in Polimi MSc programme in automation engineering. Informally, students enrolled in any Polimi MSc and PhD programmes in the engineering field	2008/2009	95 (academic year 2013/2014)



2	“Entrepreneurship Stream” at Executive MBA level	Providing MBA students with skills, analytical tools, perspectives, and experiences that may help them to generate new business ideas, assess the attractiveness of a new venture, anticipate the problems likely to be encountered as the business evolves, and predict its success or failure	Postgraduate students enrolled in the Executive MBA scheme at MIP, Polimi’s business school	2012	Around 25 participants in each of the three courses included in the stream; 10 students attended the whole stream (last edition: year 2014)
3	“Start-up Programme” within MIP “Entrepreneurship Academy” offer	Providing participants with basic skills on specific topics, i.e. business planning and entrepreneurial finance	Polimi alumni and any other individuals with at least a few years of work experience interested in the topic	2012	27 (last edition: May-July 2014)
4	“Business Planning” course	Providing participants with basic knowledge necessary to develop a business plan.	Postgraduate students enrolled in the MBA at MIP	2013	24 (last edition: October 2014)

Source: Polimi

The first three initiatives presented in Exhibit 1-1 had a different evolution over time with regard to the number of course participants. While the number of participants in the “High-Tech Entrepreneurship” course has steadily increased since the first edition (which attracted only 16 students), the number of participants in the “Start-up Programme” and in the Entrepreneurship stream have decreased with respect to the previous edition. However, this reduction of the number of participants should not be interpreted as a signal of reduced interest in EE. Indeed, the decreased number of participants in the “Start-up Programme” is in line with a generalised slight reduction of participants in the executive courses at MIP. Conversely, the lower number of Executive MBA students that selected the Entrepreneurship Stream is, at least partially, explained by the increase in the number of students who avoid selecting a specific stream but develop their own course schedule by combining courses from different streams.

Planned offers

For the academic year 2015/2016, two further EE offers are planned: a “Design Management, Innovation and Entrepreneurship” track and an “Advanced Master in Innovation and Entrepreneurship”. Both courses will be offered in English.

“**Design Management, Innovation and Entrepreneurship**” will be an elective track in the MSc in Management, Economics and Industrial Engineering. Its objective will be to provide students with skills and tools that may help them to manage the new product (service) development process from idea generation to the engineering phase and exploit the newly developed products (services) through the creation of a new business.

The “**Advanced Master in Innovation and Entrepreneurship**”, jointly developed with Solvay Brussels School of Economics and Management, is meant to help participants to adopt an entrepreneurial mindset and nurture their capability to identify new business opportunities, foresee the associated risks and ultimately outline viable strategies.



Participants will be encouraged to continuously search new business opportunities and experiment with fast testing techniques that allow to quickly abandon unfruitful ideas and design viable business models. The Master will target individuals who envisage a career for example in young entrepreneurial ventures, internet-based companies, R&D departments of a company, new business division of a corporate, global and professional service firms, high-tech businesses, incubators, tech transfer offices VC funds, or entrepreneurship centres. Another target group will be members of the founding team of a start-up, or those who envisage a career as sole proprietor entrepreneurs or family business managers or both.

Moreover, from 2015 onwards MIP will also offer an elective one-week course in the entrepreneurship area named “New Venture Creation” in the MBA international programmes.

1.2.2 Target groups

Main target groups of entrepreneurship education at Polimi

The attendees of curricular EE offers at Polimi are very heterogeneous in terms of competences possessed when entering the programmes, prior work experience, and motivations for attending entrepreneurship courses. Hence, the EE offers need to be varied and tailored to the characteristics of the target groups. All EE offers have an experience-oriented approach, as described in the following, but the educational objectives, contents and activities performed in the courses are different.

The “**High-Tech Entrepreneurship**” course is an elective course, which is part of the educational offer in the MSc in Automation Engineering programme. However, at Polimi, students who are seeking an MSc or a PhD degree in the field of engineering are allowed to attend supplementary courses offered by any MSc programme. Therefore, all these students can be considered a target group for this course. All these students generally have a strong technical background but scarce knowledge about economics. They have no work experience, they are rarely nascent entrepreneurs, but either they have business ideas they would like to develop or they would like to be entrepreneurs in the future.

The **Entrepreneurship Stream** at MIP Executive Master of Business Administration (MBA) level and the “**Start-up Programme**” target postgraduate students who graduated in different fields and have some years of work experience. These students have a variety of professional backgrounds, mostly with technical competences and experience in technical functions, but they rarely possess business knowledge. The students usually are prospective or nascent entrepreneurs. They are interested in acquiring new knowledge and especially contacts to potential investors and other entrepreneurs who may be of help when developing their new business. They also seek to learn how to make the most out of these interactions.

Continuous education

MIP also offers continuous education in the entrepreneurship field, i.e. courses for professionals that do not lead to an academic degree. In order to make it easier for target groups to identify the EE offer of the business school, MIP has recently gathered all its EE offers under the label “Entrepreneurship Academy”. The Entrepreneurship Academy includes both the Start-up Programme and short courses on Business Plan and venture financing.



1.2.3 Designing lectures and courses – basic curricular decisions

Intentions

Following students' motivation to attend the course, the key educational objective of the **High-Tech Entrepreneurship** course is helping students to identify the typical problems that entrepreneurs have to solve when transforming their ideas into new ventures. The course teaches how to frame related problems and how to find solutions. In particular, the course aims to enable students to recognise the stakeholders that may help nascent entrepreneurs to solve their typical problems.

The key educational objective of the courses in the **Entrepreneurship Stream** at MIP Executive MBA level and in the **Start-up Programme** is helping students to evaluate the attractiveness of their business ideas and to anticipate problems. The courses help putting students in contact with practitioners that may contribute to the development of their business ideas, and teaching students how to effectively communicate their ideas to investors or potential partners.

Contents

High-Tech Entrepreneurship is a 50-hour course where around 20 hours are devoted to frontal lectures, the remaining ones to meetings with practitioners and group work. The course is taught in English language.

The **Entrepreneurship Stream** in the Executive MBA programme lasts around 60 hours. More than half of the hours are frontal lectures and discussion of case studies. The Stream is organised in three courses: "Strategy in action", "Start-up" and "Entrepreneurial financing". They can be separately selected as elective courses also by Executive MBA students who chose a different stream or developed their own course schedule by combining courses from different streams. The three courses are all taught in Italian language. Students in the Entrepreneurship Stream and participants in the first two courses are supposed to develop an assignment in parallel with lectures. (For details see the "methods" section further below.)

The structure of the **Start-up Programme** has varied in the different editions, but the number of hours of frontal lectures is always around 20. Furthermore, students are also supposed to accomplish Project Work. Such Project Work consists of working in groups to develop a business model for an entrepreneurial project proposed by group members. The hours devoted to the project are highly variable and depend on the characteristics of each project. The course is taught in Italian language.

Some topics are part of all entrepreneurship courses at Polimi, including the Business Model Canvas, the structure of a business plan and entrepreneurial exit strategies. Further topics covered in all courses include the following:

- **Key challenges:** In both the High-Tech Entrepreneurship course and the Entrepreneurship Stream, the instructors expose the students to the key problems that entrepreneurs encounter in establishing a new venture. This includes gaining access to the competences, funds and complementary assets necessary for venture development as well as possible solutions to these challenges.
- **Team:** In all courses the instructors first discuss the ideal composition of the entrepreneurial team and the challenges associated to team formation. The reason is



that start-up competence and initial resource shortages are strongly connected to the characteristics of the founding team.

- **Finance:** Issues of entrepreneurial finance are also discussed in all courses. Specific issues include the origins of funding gaps in new ventures, the question how banks, equity investors, and public subsidies may contribute to fill these gaps, and the challenges associated to the use of the different financing mechanisms. At the postgraduate level, instructors also present more innovative financing mechanisms such as crowd funding and discuss their pros and cons.
- **Soft skills:** In the postgraduate courses, instructors also discuss about entrepreneurial soft skills. Students can familiarise themselves with creativity techniques and methods how to more effectively communicate the business idea, for example the elevator pitch.

Methods

Polimi's three major EE offers all apply an **experience-oriented approach**: students are encouraged to test themselves in real-world settings. There are four key steps to implement the experience approach at Polimi: mentor assignment, guest speeches, group formation and selecting business ideas, as described in the following.

For each student, an **assignment with a practitioner** who acts as a mentor is developed throughout the courses. The assignment consists of finding a business idea and developing a business model around it taking advantage of the practitioners' advice. In order to do so, students work in teams through issues of market analysis, technology viability assessment, competitive positioning, team building, and marketing strategy.

As the development of the mentor assignment is crucial, the number of frontal lectures is relatively low. Instead, many hours are allocated to **guest speeches** by entrepreneurs, professional investors, incubator officers, and policy makers who design policies that contribute to new business development. These guests primarily describe their activities to students but also listen to students' presentations of their business ideas and provide them with feedback to help them improving their business models. For further selection of mentors and guest practitioners see section 1.2.5.

Group formation. At the beginning of the courses, the students must gather in groups of three to five. The course leader of the "High-Tech Entrepreneurship" course usually provides students with guidelines for group formation. For example, the team should be as heterogeneous as possible in terms of competences of group members. The students are then free to choose whom to team up with. The rationale behind minimising interference of the course leader in group formation is that trust is crucial for success. Hence students must be free to team up with other students they trust. At post-graduate level, no guidelines are provided: course participants are free to form the groups as they prefer.

The groups then need to propose and select the **business ideas** to be developed into a business model. Students are supposed to present their ideas to their mentors a couple of weeks after having formed the groups. Since it often happens that some groups have more than one idea, mentors are responsible to help them in selecting the most promising one. In most groups one or more members are already trying to set up a company or have an idea they would like to transform into a new venture. These groups are usually encouraged to work on these ideas. However, sometimes, in the "High-Tech Entrepreneurship" course, no members of the group have any business ideas. In this



occasion, group members are asked to look for a business idea among the research groups of Polimi, e.g. by contacting the professors they know. Polimi professors are usually willing to disclose some of their research results to students. They appreciate the opportunity to explore and realise the potential for commercialisation of their research findings. Sometimes it turns out to be a useful starting point for the professors to engage in the commercialisation of their research results themselves.

Media

Media used in EE courses do not differ from those used in other courses. PowerPoint presentations and, sometimes, videos are used by both academic instructors and guest speakers.

Informal evaluation of learning outcomes and feedback for students

In all EE initiatives scrutinised here, the mentors provide an informal evaluation of students' work. Students involved in past editions of these EE initiatives provide comments to course leaders (see the "evaluation of courses and programmes" below). These comments revealed that students assess the interaction with the mentors usually as extremely useful. Of course, if a mentor has specific knowledge in the industry sector of the business idea of the students she or he is assisting, it will be easier for her or him to contribute to the development of the business model. She or he will be particularly committed to do so. However, according to past students, interactions with mentors from different industry sectors are also useful. These individuals can provide the group of students with a different perspective.

In the "High-Tech Entrepreneurship" course, throughout the course guest speakers provide students with suggestions after listening to the synthetic presentations of their business ideas. The comments of past students revealed that interactions with guest speakers are, on average, less useful than interactions with the mentors. However, sometimes guest speakers were found to have been able to provide some groups with brilliant solutions to highly specific problems.

Using results of entrepreneurship research

The results of entrepreneurship research conducted at Polimi's School of Management drive the choice of the contents of the courses, especially at postgraduate level. The contents transferred in frontal lectures to MBA students is more specific than the contents transferred in lectures to undergraduates or recently graduated students. Hence, in MBA courses the instructors tend to present also results of the research they are currently conducting.

1.2.4 Setting of entrepreneurship teaching

Locations

Teaching takes place in University classrooms.

Timing

Each EE offer described here has a different timing. The **High-Tech Entrepreneurship** course takes place from March to June of each year, and the final exam is scheduled for July. Lectures and guest speeches take place twice a week. The length of lectures is



around three hours. Guest speeches last 1.5 hours and are always followed by a 1.5 hour work on students' business models. During this time, students present their ideas to guest speakers looking for their feedback and suggestions to address unsolved problems.

The **Entrepreneurship Stream** in the Executive MBA programme is organised in three courses of 20 hours each that are scheduled from March to June. Each course is carried out on three consecutive days.

The **Start-up Programme** has no fixed structure at the moment. Previous editions lasted between six and ten days, either consecutive or distributed over one, three or six months. So far, the best solution was found to be two days per week in one month: On the one hand, meetings have then sufficient time in between to provide students with the opportunity to evolve their business ideas. On the other hand, the meetings timed this way are not too far apart, thus helping students to keep focused. Moreover, this schedule is not too demanding for executive students who have to reconcile their professional activity with participation in the course.

Formal evaluation of learning outcomes

The experiential approach adopted at Polimi relies on the assumption that in entrepreneurship courses the final exam – i.e. the formal evaluation of learning outcomes – should be an **exercise close to real business life**. Hence, both in the “High-tech Entrepreneurship” course and in the two other EE initiatives described here, the final exam consists in the analysis of a business idea and the development of a business model. Course leaders build an “evaluation committee” composed of both academics (the course leader himself and the mentors) and practitioners (venture capitalists, business angels, incubators' officers). They receive the written document and provide students with feedback after an oral presentation of the business idea. In order to carry out the exam as closely as possible to reality, the presentation is structured as an “elevator pitch”. After the presentation of the business model, the evaluation committee assigns a mark to each group.

The formal evaluation of the business models slightly **differs at MSc and postgraduate levels**. At MSc level, the participation of each group member in the final presentation is crucial. Hence the final mark takes into account whether each group member had a role in the final presentation. Moreover, despite that the mark is assigned to the group, in the High-Tech Entrepreneurship course each student has a “revise and resubmit” option: If any student of a group aims at obtaining a better mark, in a few weeks he or she can submit a new version of the business model that takes into account (at least some of) the suggestions of the evaluation committee. This new document is evaluated by the academic members of the evaluation committee who decide whether the mark of the student is to be changed – of course without changing the marks of the remaining members of the student's group.

At postgraduate level (i.e. EMBA programme and Entrepreneurship Academy courses), the individual contribution is not important: the final mark only takes into account the quality of the business model developed by the group and the effectiveness of the presentation.



1.2.5 Instructors: teachers and mentors

Professors, other employees and external lecturers of the university

Prof. Massimo G. Colombo and Prof. Andrea Rangone are the two full professors leading the activities in the entrepreneurship area at the School of Management. Prof. Colombo, Full Professor of Economics of Technical Change and Deputy Dean for Research, is the course leader of “High-Tech Entrepreneurship”. In this course, he also involves a couple of PhD students per year as tutors (see the “mentors” subsection). Prof. Rangone, full professor of Business Strategy and E-Business, leads the courses at the business school, i.e. the courses in the Entrepreneurship Stream and the Start-up Programme. He involves five assistants and associate professors of the Department. At the moment there is no chair in entrepreneurship at Polimi.

“Real entrepreneurs” as teachers

In each course, real entrepreneurs are occasionally invited to tell their experience to students. The selection of the entrepreneurs to be invited is crucial for the success of the course. The profiles of guest entrepreneurs differ depending on the target audience.

At **MSc level**, students should perceive entrepreneurs by as role models so as to become motivated to engage in and devote efforts to entrepreneurial initiatives. Hence, guest entrepreneurs tend to be young, they often are Polimi alumni, and they have recently founded start-ups. As to the industry where guest entrepreneurs operate, given the background of Polimi students, the course leaders tend to select ICT entrepreneurs. ICT industries are the most natural outlet of Polimi graduates in engineering.

At **postgraduate level** (i.e. EMBA programmes and Entrepreneurship Academy courses), students are constantly looking to enrich their network and they are particularly interested to obtain new influential contacts. Hence, guest entrepreneurs in executive courses tend to be more experienced. They usually founded successful companies which in a few years achieved high growth rates. Some entrepreneurs eventually exited the companies. Since executive students are employed in a varied range of industries, the industries in which guest entrepreneurs operate are more varied, too.

Mentors

In the “High-Tech Entrepreneurship” course, there are a couple of mentors per year who are responsible for providing students with feedback on their business ideas and advice so as to help them in developing their business models. Mentors are selected among PhD students doing research in the entrepreneurship field to be sure they have adequate competences to help students in developing the business models.

In the EE offers at postgraduate level, i.e. Entrepreneurship Stream, Start-up Programme mentors are selected from a pool of more experienced practitioners and academics: entrepreneurs, managers employed in large companies, professors, academic researchers, and PhD students who are experts of the technologies on which the students’ business ideas are based. The individuals in this pool are part of the networks of contacts of the professors involved in these two EE offers. Each group of students is assigned to the mentor whose area of technical expertise is closest to the technical field to which the students’ business idea belongs. A mentor could occasionally be assigned to more than one group.



1.2.6 Management of entrepreneurship education

Teacher and trainer management

Since there is no chair of entrepreneurship at Polimi at the moment, no selection has been made to identify those academics who are best skilled and most suitable to teach EE courses. The academic researchers to be involved either as teachers of specific topics or as mentors are selected by the full professors responsible for the courses. In order to select the researchers to be involved, the full professors responsible for the courses take into account the competences of the candidates, their attitude, and their willingness to be involved in the programmes. No specific incentives are provided to teachers. There is no specific approach for “teaching the teachers” about how to teach entrepreneurship.

Managing student support

Student support is part of the tasks to be performed by **mentors**. For effectively managing the mentors it is crucial to select them appropriately, evaluate their work and ensure their commitment. As the criteria for mentors’ selection have already been described (see the “mentors” paragraph above), this paragraph will focus on evaluation of their work and ensuring their commitment.

In all EE offers described here, the evaluation of mentors’ work is based on the **comments provided by participants** at the end of the courses (see also “evaluation of courses and programmes” below). If participants are not satisfied with the work of some mentors, course leaders will avoid assigning other groups to these mentors in the future.

While the methods for evaluating the mentors’ work are similar, the three EE initiatives differ in the activities to ensure mentors’ commitment. In the “High-Tech Entrepreneurship” course, commitment is ensured by using both monetary and non-monetary incentives. First, mentors receive an additional payment for their mentorship activity. In addition, they are made responsible for contacting the guest practitioners, arranging their speeches and facilitating the relationships between these guests and students. This additional responsibility is seen as a valuable opportunity for mentors. As the mentors are doing research in the entrepreneurship field, they are very interested in enlarging their network of contacts with both entrepreneurs and financiers or policymakers providing support to entrepreneurs.

In the postgraduate EE initiatives, mentors’ commitment is ensured relying on non-monetary incentives. As each mentor is assigned to students that are developing business ideas in her or his area of expertise, the mentor will be interested in closely following the development of students’ business model as this may generate spill-overs for her or his own professional activity.

Management of curricular integration and attracting new groups of students

As regards marketing the three EE offers among prospective students, a clear difference exists between initiatives at undergraduate and postgraduate levels. The “High-Tech Entrepreneurship” course is not marketed at all among students. It is just included in the list of elective courses offered to MSc and PhD students.

On the other hand, ad hoc marketing actions are in place for the Entrepreneurship Stream and the Start-up Programme. These marketing actions differ between the Entrepreneurship Stream at the Executive MBA level and the Start-up Programme. Since



the three courses included in the Entrepreneurship Stream are part of the list of courses that master students may attend during the second year of their Executive MBA programme, marketing simply consists in presenting the contents of the three courses to students and highlighting the benefits of attending the whole stream. The presentation of the Stream and of its courses usually lasts between 15 and 30 minutes, it takes place at the beginning of the second year of the Executive MBA programme, and it is carried out by some of the professors involved in the courses. Conversely, the “Start-up Programme” is marketed through MIP’s website and through an ad-hoc event that takes place some weeks before the course starts. This event is organised to discuss topics related to entrepreneurship and present the course. Prospective students are invited to attend the event using both MIP’s mailing list and MIP’s website. In marketing both the Entrepreneurship Stream and the “Start-up Programme”, the experience-oriented approach is highly emphasised as the main strength of the EE offer.

Evaluation of courses and programmes

All entrepreneurship courses are evaluated by participants through standardised evaluation forms that are used to evaluate any courses offered at the University or at the MIP business school.

At **MSc** level, at the end of each course, students are required to answer an evaluation questionnaire with 19 items and a four-point Likert scale in the four groups: (1) Interest and satisfaction with the course; (2) learning activities (e.g. contribution of the teachers to the learning process, co-ordination between different teachers, adequacy of study load, usefulness of course material); (3) course organisation (e.g. availability of teachers for providing explanations, clarity of the structure of the final exam); (4) infrastructure.

At **postgraduate** level (i.e., EMBA programme and Entrepreneurship Academy courses), students are required to evaluate each module (a module consists in two lecture hours) by scoring on a five-point Likert scale for four items: (1) usefulness of module content; (2) contribution of the teacher(s) to the learning process; (3) usefulness of course material; (4) self-evaluation of the previous knowledge of the subject addressed in the course. The results of these evaluations do however not allow conclusions about the development of students’ entrepreneurial mindsets, skills and behaviour through the course.

For all offers, students are also encouraged to provide the course leaders with any constructive comments to improve the course.

So far, the comments provided by past participants have been taken into account to improve the courses, but the changes introduced in the course programmes have always been marginal. For example, course leaders have started placing more emphasis and devoting more time to the topics that students have highlighted as more interesting or more difficult to understand due to lack of previous knowledge.

Comments provided by past participants reveal that both MSc and postgraduate students appreciate the experience-oriented approach. MSc students particularly value the opportunity to realise a group work in a team whose members have heterogeneous competences and the interaction with the mentors. Students enrolled in the EMBA programme and in Entrepreneurship Academy courses mainly value the opportunity to enlarge their networks of contacts by meeting entrepreneurs, managers and potential investors and the opportunity to find team mates for their business ideas. Moreover, they appreciate the opportunity to work on real-life cases.



Management of continuous education

The Start-up Programme is part of the continuous education initiatives realised by MIP. These initiatives also include free events and, more importantly, short for-pay courses (from one to three days) on specific topics. For example, during this study year, MIP has offered both courses on Business Planning and a course on Financing through crowdfunding.

1.3 Extra-curricular activities in entrepreneurship education

Overview about extra-curricular entrepreneurship activities

Two notable extra-curricular entrepreneurship activities are running at Polimi, both operated by PoliHub: Switch2Product² and CupCake³. Switch2Product is an initiative of Politecnico di Milano together with the Politecnico di Milano Foundation and the Milano Municipality, in collaboration with the Banca del Monte di Lombardia Foundation and supported by Microsoft YouthSpark as well as Cariplo Foundation. CupCake is a partnership project by Politecnico di Milano, PoliHub and the Politecnico di Milano Foundation.

A third notable activity, Microsoft YouthSpark, was discontinued at the end of 2013. Exhibit 1-2 presents the main characteristics of these activities.

Exhibit 1-2: Overview of extra-curricular EE activities at Polimi

No.	Name	Objectives	Target group	Offered since	No. of participants in the last edition
1	Switch2Product	Promoting creativity and idea generation, which may lead to the development of new high-tech products or services, or innovative design	Any person or team with a scalable and high potential idea (not confined to Polimi)	2010	150 (sixth edition that took started in October 2013)
2	CupCake	Stimulating the development of ideas for the start-up of creative enterprises able to respond to new needs and new target markets.	Designers with, at least, a Bachelor degree, who are currently unemployed or have no work experience yet (not confined to Polimi)	2013	21 (second edition, started at the beginning of 2014)
3	Microsoft YouthSpark	Connecting young people with greater education, employment, and entrepreneurship opportunities.	Undergraduate students (not confined to Polimi)	2012 (ended in 2013)	500 (in 2013)

Target groups of extra-curricular activities

The audience of Polimi's extra-curricular activities is very heterogeneous. The initiatives are directed to both undergraduates and recent graduates, be they from Politecnico di Milano or other universities. Switch2Product targets any person or team with a scalable

² See <http://www.polihub.it/en/what-we-do/scouting/s2p-switch2product-sesta-edizione/>.

³ See <http://www.makeyourcupcake.it/>.



idea; CupCake targets designers with at least a Bachelor degree who are unemployed or have no work experience yet.

Objectives, contents and methods

The aim of the extra-curricular activities is to help young people with promising business ideas to develop the ideas for possibly launching a new venture. To do so, idea proponents are provided with both training and, eventually, incubation services offered by PoliHub staff.

In **Switch2Product** any person or team with a scalable and high potential idea is encouraged to send a description of the idea to PoliHub. PoliHub staff will evaluate these descriptions and select the top ten projects. The proponents of these projects will then gain access to the Innovation Camp, a week of training, tutoring, and team building that will help them to understand how to develop their business ideas. After this camp, the top five meritorious projects will be selected and gain access to both incubation for a three-month period in PoliHub facilities as well as support and training in business plan writing. At the beginning of 2014, the seventh edition of Switch2Product was launched.

The **CupCake** initiative reached its third edition in 2014. CupCake is about placing creative designers with innovative product or service ideas into a European company in a three-month internship, business incubator or development agency. A mentoring service will support the designers during and after the internship. The service intends to provide technical and economic assessment of the projects, the production of prototypes and service testing.

Using results of extra-curricular activities of entrepreneurship education

Extra-curricular activities are currently separated from curricular EE activities. The only connection between the two types of activities is a recent initiative of PoliHub: Since academic year 2013/2014 PoliHub offers three months of free incubation as an award for the best project realised in the “High-Tech Entrepreneurship” course.

Locations

The Switch2Product and CupCake extra-curricular activities take place at PoliHub facilities and in other locations. Locations varied across the different editions of the two initiatives.

Persons involved in extra-curricular activities

Extra-curricular activities mainly involve PoliHub staff.

1.4 Institutional aspects of entrepreneurship education

Organisational set-up and change

Curricular EE courses are a fairly recent phenomenon at Polimi, not affecting the whole of the university yet. Currently the courses are confined to the business school and, on a lower level, to engineering schools. Hence there are no specific entrepreneurial entities yet neither at University level nor at the business school. Moreover, there are currently no plans for introducing any entrepreneurship-related entities or management positions.



Laws, statutes and codes

Entrepreneurial activity of Polimi students is not regulated by any specific rules or laws. Conversely, the participation of Polimi professors in spin-off companies is subject to national laws (Ministerial Decree no. 168 of 10 August 2011) and University rules. In particular, there is a clear procedure that Polimi researchers must follow for requesting recognition of their start-ups as spin-offs.⁴

At the moment, there are no specific incentives neither for staff nor other stakeholders to contribute to EE.

Mindsets and attitudes

At the moment, there are no structured activities at University level to raise awareness about the importance of entrepreneurship and entrepreneurship education. However, a series of activities has been realised by both the MIP business school and PoliHub. Specifically, at MIP, in both curricular courses and events open to a wider public, successful entrepreneurs are often invited to tell their experiences. The presentations of these guests offer the opportunity to make the audience aware of the business school's EE offers. PoliHub frequently organises lectures by leading players of the start-up market, seminars focused on start-up business development and workshops on specific key-technologies. These events are often open to incubated start-ups and prospective entrepreneurs.

1.5 Outreach to external stakeholders of entrepreneurship education

Relationships with PoliHub

PoliHub, Polimi's incubator, is a major co-operation partner in EE. PoliHub is partially involved in some EE initiatives by Polimi and is responsible for extra-curricular initiatives. EE lecturers interact with PoliHub staff. In particular, in the "High-Tech Entrepreneurship" course, PoliHub has a double function. First, every study year one member of the incubator staff is part of the committee that evaluates the business models developed by the students who attended the course. Second, since study year 2013/2014, PoliHub is offering three months of free incubation as an award for the best entrepreneurial project. Since 2013, PoliHub is offering free incubation services also to the best projects in the "Start-up Programme".

Relationships with enterprises and financial institutions

As above mentioned, entrepreneurs and managers from companies and financial institutions are invited to take part in the EE courses held at Polimi as guest lecturers. Some practitioners have frequently participated in Polimi's EE initiatives, e.g. Diana Saraceni, Senior partner of 360 Capital Partners, Marco Corradino, founder of Volagratis.com, and Vito Lomele, founder of Jobrapido. However, no formal agreement exists between Polimi and the companies and financial institutions of these practitioners.

⁴ For details see http://www.polimi.it/uploads/media/university-spin-off-regulations_01.pdf.



International relationships in entrepreneurship education

In September 2014, MIP has signed a formal agreement with **Solvay Business School** concerning a Double Degree for an “Advanced Master in Innovation and Entrepreneurship” that will be jointly offered by the two business schools starting from September 2015.

No other international relationship has been developed in the EE area as all the courses currently offered at Polimi and at the business school are in Italian. However, in 2015 the business school will start offering the first entrepreneurship courses in English (i.e. the entrepreneurship concentration in the international MBA programme), and the University will extend its offer by launching the “Design Management, Innovation and Entrepreneurship” elective track in the MSc programme in Management, Economics and Industrial Engineering. The leaders of these new courses are currently contacting foreign scholars in the entrepreneurship field to involve them in future editions of these courses.

1.6 Impact and lessons learned

1.6.1 Evaluating impacts of the entrepreneurship education approach

Overview of impact evaluation methods applied

At the moment there are no specific activities at Polimi to measure the impact of the EE initiatives beyond course evaluation (see the section “evaluation of courses and programmes” above). In particular, there are no official sources of information about start-ups created by Polimi alumni.

Studies about the involvement of Polimi alumni in start-ups

However, some researchers from Polimi’s School of Management believed that the technical competences provided to its students should be a crucial source of new venture creation at the local level. Hence, the School of Management recently conducted a study for evaluating start-up creation by Polimi alumni. This study revealed that out of the 62,492 Italian alumni that received a BSc, MSc or PhD degree at Polimi between 2000 and 2009, 3,375 alumni acquired shares in young companies. 2,852 (4.6%) of these Polimi alumni were part of the founding teams of those ventures. Altogether, these 2,852 alumni founded 3,115 new ventures by mid 2014. Nearly 80% of these ventures are located in the Lombardy Region. Specifically, 38% are located in the Province of Milan and other 40% in the remaining provinces of the Region.

Another study conducted at Polimi School of Management showed that MIP alumni also contribute to new venture creation at the local level. Out of the 1,736 Italian alumni that received an MBA (or Executive MBA) degree at MIP between 1993 and 2012, 302 alumni acquired shares in young companies. 214 (13%) of these alumni were part of the founding teams of these ventures. Overall, these 214 alumni founded 269 new ventures by mid 2013. The 269 ventures are mainly located in the Lombardy Region: 37% of these ventures are located in the Province of Milan and other 14% in the remaining provinces of the Region.

These studies provide an impression of the impact of Polimi alumni on entrepreneurship activities. However, the studies do not allow to draw a direct relationship to entrepreneurship education Polimi’s activities.



1.6.2 Lessons learned

Summary of lessons learned from this case

Designing and running Polimi's entrepreneurship courses allows to formulate the following lessons learned:

- Students were found to appreciate Polimi's experience-oriented approach. MSc students particularly value the opportunity to work in teams with different competences and the interaction with mentors. Students attending the EMBA programme and Entrepreneurship Academy courses mainly value the opportunity to enlarge their networks.
- **Size of the class.** The class must not be too large, otherwise the interaction with the guest practitioners becomes too complex. On the other hand, if the size is too small, there are limited opportunities of cross-fertilisation of the business ideas and interactions among students with different competences. The ideal size according to Polimi's experiences may be around 50 students.
- **Composition of the groups.** The student groups working on the business idea must not be too large as well. In large groups students may find it difficult to find a role, while in small groups the probability that innovative solutions emerge are limited. The ideal size was found to be three to five students per group. Moreover, groups consisting of students with different educational backgrounds are likely to generate more innovative projects.
- **Importance of attending classes.** Attending lectures and, in particular, meetings with guest practitioners and with mentors is crucial to help course participants develop their business models. Hence, if the course is not mandatory, the course leader should constantly remind students about the importance of attending classes.
- **Need for incentives.** In order to stimulate students to work and mentors to provide adequate support to students, providing the right incentives is crucial. Polimi's experience is that offering an award for the best projects had positive effects on the efforts of students. Besides the group incentive provided by the award, students seeking an MSc degree may also need individual incentives. The "revise and resubmit" formula used in the "High-Tech Entrepreneurship" course has been proven to be particularly effective. As to mentors, monetary and non-monetary incentives were found to be crucial to keep them committed.

Transferability to other universities

The experience-oriented approach adopted at Polimi may easily be transferred to any technical university and to any university offering degree courses designed to allow graduates operate in creative industries, for example cinema or media. Some changes may be required for an effective transfer of the approach to other universities, considering the universities' specific circumstances. For example, guest practitioners should be selected in the industries that are the natural outlet of target students.



References

Research for this case study was conducted by Evila Piva, Assistant Professor at Polimi, on behalf of the study for supporting the entrepreneurial potential of higher education (sepHE). Sources and references used include desk research plus:

Interviews

- Prof. Massimo Colombo, full professor Full Professor of Economics of Technical Change and Deputy Dean for Research at Polimi School of Management responsible for the *High-tech entrepreneurship* course, interviewed on September 5th 2014, in Milan.
- Francesca Tenca, PhD student at Polimi who has been tutor in the 2013/14 edition of the *High-tech entrepreneurship* course, interviewed on September 5th 2014, in Milan.
- Claudia Pingue, COO at PoliHub, and Domenico Pannofino, staff member at PoliHub, interviewed on September 10th 2014, in Milan.
- Dr. Raffaello Balocco, assistant professor at Polimi School of Management, involved in the EMBA entrepreneurship courses and responsible for the *Entrepreneurship Academy* courses, interviewed on September 11th 2014, in Milan.
- 2 focus groups with small groups of students have been organized (for privacy reasons, the names of the students cannot be reported here).
 - On December 2nd 2014: focus group with 5 students of the 2012 edition of the EMBA programme (i.e., students that started attending the EMBA programme in 2012 and thus attended the elective courses during 2014)
 - On December 13nd 2014: focus group with 6 undergraduate students who attended the High-Tech Entrepreneurship course during 2014

All these interviews were face-to-face interviews.

Websites

- Programme of the high-tech entrepreneurship course available at: https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_D_ETTAGLIO_RIGA_MANIFESTO=evento&aa=2012&k_cf=225&k_corso_la=436&k_in_dir=XEN&codDescr=090917&lang=IT&semestre=2&idGruppo=2573&idRiga=150280
- Website of MIP, Polimi business school: <http://www.mip.polimi.it/mip/en.html>
- Information on the Entrepreneurship Academy: <http://www.mip.polimi.it/mip/it/Corsi-Brevi/Entrepreneurship.html>
- Website of Polimi incubator: <http://www.polihub.it/en/>
- Rules for the participation of Polimi professors



Annex

Course description “High-Tech Entrepreneurship”

TITLE	High-tech entrepreneurship
PROFESSOR IN CHARGE	Prof. Massimo G. Colombo Massimo.colombo@polimi.it Phone 02.2399.2748 Prof. Marco Giorgino Marco.giorgino@polimi.it Phone 02.2399.2759
LECTURERS	Prof. Massimo G. Colombo Prof. Marco Giorgino Dott.ssa Daniela Luz Laurel Ing. Mario Salerno
MISSION AND GOALS	Generating interest for the foundation of a high-tech company. Providing a comprehensive overview of the processes and problems concerning the creation of a high-tech company, the managerial challenges involved and the sources of financing
SUBJECT AND PROGRAMME OF THE COURSE	The creation of new technology-based firms. Entrepreneurship in high-tech industries in Italy and in the world. The business plan. Organisational issues and HR management. The protection and commercialisation of an innovative technology. The role of incubators. The development of new technology-based firms. The performances of new technology-based firms: the founding team, the knowledge gap and the funding gap. The access to external resources and competencies: strategic alliances and acquisitions. The financing of new technology-based firms. The financing of new technology-based firms: equity, debt capital and public subsidies. The evaluation of new technology-based firms. Listing on the stock exchange. Public policies for new technology-based firms.
TEACHING ORGANIZATION	Lessons: 21 hours Laboratory work: 18 hours Guest speakers: 15 hours
TEACHING MATERIALS	Articles and transparencies
LEARNING EVALUATION	Development of the business plan of a new venture based on an innovative technological idea in the field of study of the students (e.g. based on the research projects carried out in the corresponding department at Politecnico).
ACADEMIC CALENDAR	From 10 March 2010 to 17 June 2010 Wednesday (LEZ- ESE) 15.15 – 18.15 Classroom CT 68 Thursday (LEZ- ESE) 16.15 – 19.15 Classroom D 2.4
SECRETARY'S OFFICE	Sig.ra Giuseppe Di Tavi giuseppa.ditavi@polimi.it Phone 02.2399.2774
LOCATION	Campus Bovisa

Source: http://www.ricerca.polimi.it/uploads/media/Colombo_Giorgino_Hig-tech_entrepreneurship_01.pdf (last accessed 11 March 2015)



Course description “Executive MBA Stream in Entrepreneurship” and “Start-up Programme”

Program	Description	Key topics
Executive MBA Stream in Entrepreneurship	The stream aims at supporting prospective entrepreneurs and executives in developing their own personal and corporate business ideas. At the conclusion of the course, students will have mastered the wide array of capabilities they need to set up their own business initiative successfully.	<ul style="list-style-type: none">• Strategy II – Strategy in action• Strategy II – Start up• Entrepreneurship and new technologies The stream is based on action learning, in this case project work where participants propose and develop a business plan that is evaluated by a committee composed of MIP professors, executives, venture capitalists and business angels. During the course, students will be assigned to a mentor (e.g. a technology expert, entrepreneur, venture capitalist, business angel, corporate executive, etc.) who will act as their point of reference.
Start-up Program	Master course targeting entrepreneurs who have recently launched a start-up company or aspiring entrepreneurs, with the goal of supporting them in fine-tuning their projects.	<ul style="list-style-type: none">• Industry foresight, Strategy and Business models• Market insight and Fast prototyping• Operations and Organisation design• Economics• Personal development – Coaching The program is based on action learning, mixing lectures with assignments and project work relating to business initiatives proposed by participants and supported by tutors. The project will be evaluated by a committee composed of MIP professors, executives, venture capitalists and business angels.

Source: <http://www.mip.polimi.it/mip/en/globals/AREA/Entrepreneurship>, last accessed 11 March 2015.