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An Extracurricular Project-Based Training Course in Innovation and Entrepreneurship Delivered to a Transdisciplinary Group of Students in Engineering, Social Sciences, Arts and Medicine

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Abstract: Limited information is available on the design of combined innovation and entrepreneurship training courses, and with even less available on delivering such courses to multidisciplinary teams. We designed an extracurricular project-based training course in innovation and entrepreneurship and delivered it to transdisciplinary teams of students who were then asked to build an autonomous mobile system for healthcare applications and to create a business model to implement it. The course was created through a backward educational design and design thinking to assist teams of students in transforming an idea into a technical solution and developing it into a business model through a project-based learning experience. A transdisciplinary group of 31 students, mostly in bachelor's degree programs, worked either all together, in plenary sessions, in subject-specific groups, or in teams of 5–6 members, under the guidance of their trainers during a ten-day summer school. We used questionnaires to evaluate the changes in student perceptions and a satisfaction survey to evaluate the students' experience. The qualitative observations together with the results of the quantitative instruments revealed positive changes in student perceptions towards innovation and entrepreneurship. Additionally, the satisfaction survey offered positive feedback and some recommendations for further improvement. The implementation of the course showed that planning is important, but flexibility is essential, that covering fewer topics might lead to deeper understanding, and that managing expectations and practicing empathy are crucial.

Keywords: active learning; innovation and entrepreneurial training; design thinking; backward educational design; project-based learning; evidence-based pedagogical innovation

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1. Introduction

As innovation and entrepreneurial (I&E) skills are regarded as a pathway to employability and prosperity, higher education institutions across the globe have been exploring ways to develop such skills through both regular degree programs and lifelong learning courses, bridging industry and academia [1]. As the terms innovation and entrepreneurship are difficult to define, we use the "standard" definitions, accepting that the innovation created by an individual or an institutional unit is "a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users or brought into use by the unit" [2]. Entrepreneurship is "the capacity to act upon opportunities and ideas, and transform them into value for others (the value being financial, cultural, or social)" [3]. Training

in innovation and entrepreneurship is a challenge for both higher education institutions [4] and large companies; a recent study showing that, although managers see the human capital as central to innovation success, innovation training rarely happens in a structured way [5].

Traditionally, innovation and entrepreneurship have been taught in undergraduate courses concentrating on business or product development [6], but they have evolved into a common field of study in graduate business, engineering, and design programs [7–9]. More recently, innovation and entrepreneurship have entered other fields, such as humanities [10], arts [11], and medicine [12], or addressed global challenges, such as sustainability [13,14]. Though the number of universities that offer courses related to entrepreneurship has grown steadily [6,15], the higher education institutions that have adopted study programs in innovation and entrepreneurship, which mix technical skills development with small business management training, are still fairly uncommon [16]. Among the programs available, several universities offer multidisciplinary biomedical engineering programs that combine technological and business model innovation [17].

Despite the increasing number of reports that have been published on entrepreneurship [18] as well as on innovation [19], the literature on innovation and entrepreneurship education remains rather sparse, and there is a distinct gap in the body of knowledge regarding the development and evaluation of such programs [9]. Information on the design criteria and the planning of such I&E programs or on combined innovation and entrepreneurship extracurricular courses offered by higher education institutions is still limited [20]. Moreover, entrepreneurship education is complicated by the fact that there is little clarity about what its outputs and outcomes should be [21]. Similarly, innovation education is affected by a lack of clarity around the wide variety of obstacles and constraints influencing the creative process (scarce resources, lack of autonomy, design regulations, etc.), so a comprehensive understanding and cross-disciplinary integration into training programs is needed [22].

Limited information is available on the design criteria and the planning of combined I&E training courses or programs. Reviews of entrepreneurship education programmes and courses show that there is a large diversity with respect to objectives, philosophy, content, pedagogy, and learning outcomes [23]. In the same way, little uniformity is observed in courses focusing on innovation [24]. In addition, there is debate around the issue of theory versus practice, with defenders of the 'theory for practice's sake' philosophy claiming that theory is the most practical thing that we can teach to students [9], while supporters of experiential approaches advocate for more hands-on methods [23].

Finally, there is an ongoing discussion regarding individual or collaborative approaches to entrepreneurship and innovation [4]. Entrepreneurs have been viewed more often as lone players that like to compete than as team players willing to collaborate openly [25]. However, other authors have argued that individualism and collectivism are not necessarily polar ends of the same continuum, and, in several cultures, collectivist values are well correlated with entrepreneurial success [26]. Similarly, innovation was previously fuelled mostly by individual endeavours, whereas in modern times, the growing complexity of challenges faced means that entrepreneurship has become more of a team effort [27]. A recent trend advocates learning about entrepreneurship and practicing innovation in heterogeneous groups [28].

In an attempt to address some of the open questions briefly summarized above, this study reports the planning of a coherent extracurricular training course that mixed the topics of innovation and entrepreneurship. We offer details about the design criteria and how we used backward educational design [29] to establish learning outcomes, choose the appropriate assessment methods, and devise the learning experience, along with how design thinking [30,31] was used to plan an active [32], student-centred teaching and learning experience.

The novelty of our approach comes from the choice of the target group, with the goal being to activate a diverse set of students (from engineering, social sciences, life sciences,

and the arts) and foster transdisciplinary teamwork through project-based learning. We opted for an experiential approach, asking the teams to design an autonomous mobile system for applications in healthcare spaces and to conceive a business model to implement that idea. Through this process, 31 students, mostly in bachelor's degree programs, either worked together in subject-specific groups, in teams of 5–6 members, or individually, learning by doing, under the guidance of their trainers, during a ten-day summer school.

The purpose of our study was to document the training course and to investigate its outcomes, focusing on a single case of its delivery in a summer school, and asking, as a research question, whether there was an improvement in the student perception of the knowledge, skills, and attitudes required for successful innovation and entrepreneurship after completion of the course. For data collection, we used a combination of research instruments, including written perception questionnaires (before and after) and a satisfaction questionnaire as well as direct observation. We report the results of the study, discussing the qualitative observations in correlation with the results of the quantitative instruments used, address the limitations of our study, and make suggestions for further research.

2. Methods

We used *backward educational design* [29], an approach which consists of three stages: identifying the desired results (the learning outcomes), determining the acceptable evidence (criteria and methods of assessment), and planning the learning experience and teaching activities. When formulating learning outcomes, we followed the Bloom's revised taxonomy [33], which makes clear distinctions between the increasing levels of abstraction and complexity that students can achieve. In line with the hierarchy of learning outcomes, from secondary to important and essential, the assessment methods can be diverse, moving from informal checks of understanding, observation, and dialogue to tests or complex projects. The planning of the learning experience and teaching activities was based on *design thinking* [31,34] a human-centred approach, which emphasizes the discovery of the needs and aspirations of the user and proposes various methods to generate ideas, prototype, and test solutions to meet those needs. Key to design thinking are several concepts, such as: empathy, which all human-centred enterprises have at their core; a mindset that accepts ambiguity, unleashes creativity and embraces failure as a natural occurrence on the path to success; and a process that involves experimentation and collaboration [35,36].

To measure the change in student perception of the competencies required for successful innovation and entrepreneurship, we designed written questionnaires with three sections (*Knowledge*, *Skills*, and *Attitudes*), in which students had to choose responses on a 1 to 5 Likert scale to represent to what extent they agreed with each items.

Such questionnaires are research instruments that allow the description of the relationships between variables in a certain situation and the identification of changes between those relationships over time [37–39]. This method is efficient in gathering data, and it also provides the possibility for descriptive, inferential, and explanatory information. By operating using key factors and variables, questionnaires are standardized instruments that provide information for correlations and comparisons, offering data to check our research hypotheses for the target population. The data analysis included scoring the results, then constructing a database with the information and the statistical data processing using SPSS 20.0 [40]. We calculated the normality of the distribution of scores for each variable in our instruments and, based on the results obtained, we chose the non-parametric Mann–Whitney U-test for independent samples in the statistical processing [41] of our data.

To minimise observer bias, observations were made by all trainers, who spent a considerable amount of time with the students in class as well as during coffee and lunch breaks, etc., getting to know the participants and how they reacted and interacted. The observations collected by each trainer were gathered and cross-checked for consistency to lower subjectivity.

3. Course Design

3.1. Course Goals and Context

The main goal of the summer school was to introduce students to innovative design techniques as well as to basic entrepreneurial approaches. By working in teams to transform an idea into a technical solution and advance it into a business model, students would develop complex competences: knowledge of the I&E concepts and methods, soft skills that are crucial for technical and business expansion, and attitudes and values that would benefit the individual and the community. Subsequently, we sought to prepare a core group of academics in planning and executing an inspiring project-based learning experience for their students. The teachers would work as a team to design, implement, and evaluate the course offered as a summer school, acquiring, or expanding their knowledge in educational design as well as their teaching skills for active learning by means of inquiry and projects.

The summer school was planned for a diverse target group, focused especially on undergraduate students new to the topic of I&E but who have an interest in developing their competences. As solving complex real-life problems requires diverse competencies from different fields, our training course attempted to mimic real life situations, giving students the chance to cooperate in multidisciplinary teams.

To address the goals mentioned above, we chose as a challenge a complex task: (i) to design an autonomous mobile system for automatic monitoring and controlling applications in healthcare spaces and (ii) to conceive a business model to implement their idea. Given the challenge, to ensure an experience that was as authentic as possible, even mimicking real life situations, we considered making a balanced selection of students with diverse backgrounds, which included engineering and computer science, business, law and psychology, arts, and medicine.

3.2. Learning Outcomes

The needs of the target groups have been explored in previous events [42]. The students recognized a poor preparation in innovation and entrepreneurship and the need to develop knowledge of methods that stimulate creativity and problem-solving skills, as well as the ability to use that knowledge in practical situations. They also expressed the hope to work together with other students with similar interests and the need for deeper human interaction and connection, particularly after having online classes due to the pandemic. The students voiced their expectations regarding a stimulating environment where open discussions and initiative would be encouraged. Moreover, they recognized that their previous education experience did not foster risk taking and showed little tolerance for failure on the way to success. Under these circumstances, they expressed hopes for an authentic and relevant learning experience [1] that would make them feel challenged and motivated as well as self-confident and appreciated. As was shown earlier [43], such needs for authenticity and active participation are not specific to a given university, but rather, they apply to the general student population.

The entrepreneurship competence is multifaceted, consisting of a diverse collection of knowledge, skills, and attitudes. Relevant skills for entre- and intrapreneurs [44] include the capacity to act upon opportunities and ideas, to develop a vision, and to implement it, transforming those ideas into values for others. They are deep rooted in individual skills, such as creativity, critical thinking, and problem solving, the ability to embrace ambiguity, assume risks, and take initiative [45], but they must be complemented by the capacity to work collaboratively, inspiring and motivating a team to achieve a common goals [46]. Moreover, among positive entrepreneurial attitudes, one could also mention optimism and confidence, empathy, and caring for people and the environment [3].

Innovation competency is inherently intertwined with entrepreneurship [47]. It requires knowledge of the innovation process and the basic principles of research methodology. It embodies different skills, starting with curiosity and intuition, continuing with imagination and creativity, and going further with unconventional thinking and problem solving. It also calls for tolerance for failure coupled with perseverance, and it involves

the ability to ask questions, observe, experiment, ideate, prototype, and test/evaluate solutions. In addition, although it might be an individual trait when it comes to dealing with complex, real-world challenges, the innovation competency could benefit from the ability to communicate with others and to work effectively in teams. The desired attitudes for innovators are well matched with those for entrepreneurs [48].

In our attempt to identify the enduring knowledge, skills, and attitudes that students should develop during the course, we chose to train students in applying design thinking procedures [34] for basic product design and applying customer discovery techniques to generate and test ideas for a corresponding business model [49]. We selected higher competency levels in the Bloom's revised pyramid [33], focusing on "apply" as "remember" and even "understand" seemed rather modest, but aiming ambitiously for "analyse", "evaluate", and "create", despite the lack of exposure for the target group to the I&E topic and the time constraints of the class.

For the enduring knowledge, skills, and attitudes that students should develop during the course, we identified the following as learning outcomes (LO). Students will be able to:

- LO1.—exercise curiosity and intuition, imagination and creativity, unconventional thinking, and problem solving for product design,
- LO2.—practice active dialogue and careful observation to identify and define problems as well as to evaluate solutions,
- LO3.—realize prototypes and test solutions using the resources available,
- LO4.—identify customer segments, determine customer needs, estimate commercial potential, and recognize opportunities for new businesses,
- LO5.—use the customer profile map to build a value proposition canvas,
- LO6.—use the business model canvas to generate and test the key aspects of a new business model for a lean start-up,
- LO7.—work in transdisciplinary teams, communicating effectively, planning, executing, and assessing all work done as a team,
- LO8.—build self-confidence and resilience, navigate ambiguity, and maintain a positive and ethical attitude.

3.3. Assessment of Student Learning

In line with the hierarchy of learning outcomes, the assessment methods ranged from oral questions to project evaluation. The dialogue and class work observation had the role of continuously monitoring understanding, whereas the final presentation and defence of the project were meant to reveal the effectiveness of the course.

The final assessment was complex and multicriterial. Students evaluated the involvement of their teammates, whereas teams and an independent jury appraised the projects and the performance of the teams. The evaluation of the final project presentation was based on a rubric with several items that were grouped in five categories. The first item was the innovative character and the added value of the technical idea; the second was the quality of the customer discovery outputs and of the minimum viable product; and the third was the novelty and viability of the business model (including analyses of customer relations and partnerships, estimations of costs and revenues, etc.). The last two categories referred to the overall quality of the design process and to the soft skills and the values demonstrated by the teams in managing the project.

3.4. Learning Experience and Teaching Activities

The training course was designed as a 10-day-long I&E summer school, and the students worked in transdisciplinary teams on projects focusing on medical applications. Their challenge was to conceive a biomedical product (an autonomous mobile system for automatic monitoring and control applications in healthcare spaces) and a business model to commercialize it.

To address this challenge, we planned face-to-face training sessions of three types: plenary sessions, subject-specific sessions (held in three thematic groups: engineering and

computer science, business, and visual arts), and team sessions. The agenda included two two-hour-long sessions every morning, with a half-hour break in between them; the afternoon was dedicated to homework performed by all teams, with both synchronous team activities and asynchronous individual effort. With about 40 h of direct contact with the trainers and around 20 h of homework time, we estimated a total of about 60 h of activity for the participating students.

4. Course Delivery

The training course was delivered as an innovation and entrepreneurship summer school course. Students were selected based on their answers to a few questions that examined their availability and motivation. Out of the 57 applicants, 31 students were selected with care to represent engineering and computer science, business and law, arts, and medicine. Of the target group, about 10 had some episodic attendance problems.

The subject-specific workshops were organized for three thematic groups. The product development group consisted of engineers and computer scientists who focused on the technical aspects of the product. The business model development group, comprising social science students, prepared the value proposition and built the canvas. The artistic design group involved students in arts who concentrated on the aesthetic design of the product and the business logo. Medical students attended any of the three groups to represent the connection to the end beneficiaries, providing useful information and insight to all thematic groups. More details are provided in the Supplementary Materials.

The classes were held face-to-face in rooms with multiple functionalities. The equipment available to the students included development boards, batteries, wires, motors, wheels, chassis plans, measuring devices, laptops, graphical drawing tablets with stylus pen, 3D printer, etc.

The training team included 14 academics and mentors from various colleges (three from Business, three from Computer Science, three from Engineering, one from Medicine, one from Arts, one from Psychology, two from Languages & Communication) as well as invited entrepreneurs. The training staff was chosen for their complementing expertise, their dedication and passion for innovation and entre/intrapreneurship, and their interest in student-centred teaching methods. A support team of enthusiastic administrative staff and student volunteers assisted the training team during the preparation and implementation stages.

The summer school agenda in a table form and some details of the activities performed by the thematic groups in their subject-specific workshops are given in the Supplementary Materials. In the following sections, we present the main activities performed every day.

- **Day 1.** The first session started with several icebreakers to warm the students up, build their creative confidence and unleash their imaginations. Next, a complete design thinking exercise exposed the students to the entire process early on, with the goal being to conceive a useful/relevant object for their closest colleague. The second session started with the presentation of the challenge the teams had to solve during the course (generate ideas for an autonomous mobile system for automatic monitoring and control applications in healthcare spaces and a business to commercialize it). Reflection exercises allowed students to review their prior knowledge and consider what they need to learn to complete the task. Finally, team-building exercises gave students a chance to learn about each other and create teams based on shared interests and values. The students had the liberty to form teams, provided that the request for diversity of expertise was met. The homework for the afternoon was to work on building teams and identifying possible project topics. The students participated, shared thoughts, created imaginative prototypes, and discussed the anticipated duration of the first session. Consequently, a few of the team formation exercises scheduled for the second session had to be postponed for the following day. One suggestion for the future uses of the course was to reduce the time reserved for the warmup exercises in the first session.

- **Day 2**. On the second day, the focus was on team formation and on choosing a specific project topic within the overall theme. A step-by-step exercise to facilitate team formation and the assignment of roles and responsibilities (the team map) continued the exercises from the first day. The students were immersed in a medical context, being called on to think of and then choose a health-related challenge waiting for solutions. The next task, to understand the learning needs and the jobs to be completed and to conceive of a work plan, had to be shortened because the first took longer than anticipated. We had to increase the level of guidance and reduce the extent of self-reflection. In the second session, all students were briefly exposed to the business model canvas approach [49] and asked to use empathy tools to understand the customer's needs [50]. Customer discovery exercises challenged the students to think of different potential client segments and their needs, their pains, and gains, and the jobs to carry out. They worked on thematic groups, each focusing on different types of needs (technical, financial, aesthetical, etc.). The homework was to further develop the empathy maps.
- **Day 3**. On the third day, the teams were asked to integrate the information from the empathy map and finalize the client's avatars [34]. Afterwards, they worked on reassessing and redefining the project specification. The idea generation exercises from the second session were meant to unleash students' creativity and to prepare them for the solution development. However, the three exercises we used were rather long, forcing us to cut the time allotted for the discussion on building a relevant solution through an analysis of characteristics, advantages, and benefits. Instead of practising the concepts in class, as we had initially planned, we had to ask the teams to apply the concepts discussed on the products they were developing as homework.
- **Day 4**. The fourth day started with a plenary review of the initial solutions proposed by all teams. Afterwards, the students split into thematic groups and worked on developing the solutions from all perspectives: technical and functional aspects, product design and aesthetics; and the value added by their product. During the second session, the students worked in teams to share their newly acquired knowledge and integrate into insight on buyers' motivations into their designs. At the end of the session, a plenary discussion clarified the concept of value proposition [50]. The homework challenged the students to create a customer survey integrating technical, aesthetic, and business questions to test their assumptions. Most of the students required more support from the mentors and an extended time allocation than anticipated. At the end of the day, the students recognized that, although the tasks had been new to them and challenging, the exercises helped them to make progress and the group or team interaction was useful.
- **Day 5**. On the fifth day, the students had to test their initial solution and confront the basic concepts of their business models with the expectations of potential clients, by conducting structured interviews. Due to the pandemic context (which imposed social distancing constraints), we chose to perform the customer discovery activities by phone, calling selected relevant people from avatar categories and asking the questions prepared in advance. We encouraged students to 'get out of the building' [51] and use the validated Lean Launchpad methodology [52]. Initially, the students found calling the potential customers rather challenging, even if they had the survey well prepared in advance. In the second session of the day, the teams reunited to exchange results of the customer discovery questionnaires, readjust the technical specifications, and develop an improved solution. The exercises revealed striking differences among students, originating in innate communication skills as well as in the lack of prior training. Reflecting on the process, the students were able to better understand their strengths and weaknesses and learn from the positive and negative experience of their peers. It became obvious to us that, for future courses, the communication dimension of the training had to be extended by means of mock interview exercises and role-playing. At the end, despite the difficulty of their endeavour which took students out

of their comfort zone, they acknowledged that the exercises had been interesting and useful.

- **Day 6**. During the first session of the second week, the teams integrated the information from the first round of customer discovery exercises to build the first prototype and prepare the marketing, distribution, and financial models. The students found the tools used, the Sales Funnel [53] and Business Chassis [54], to be practical and easy to employ; they gained confidence in explaining and applying relatively new concepts. In addition, the experience gained with the first round of interviews proved to be helpful for the students, who felt better prepared to design the interviews for the second round of customer discovery (assigned as homework).
- **Day 7**. The first session started with a plenary review of the second surveys, followed by work in thematic groups to create the second round of interviews and test the first prototype. As the channels of communication had already been opened, the students were more focused and confident, and they worked more effectively. They learned from their own progress that, once 'the ice is broken' and the awkward tension removed, familiarity with the ideas discussed was able to reduce shyness significantly. In the second session, combining all findings from customer discovery into design characteristics of a minimally viable product proved to be equally challenging as all students emphasized their own findings. To reach an agreement, they learned to cluster their ideas and rank them based on impact and feasibility before making choices. They learned to listen and make judgements based on evidence, not on personal biases. Carried away by the exercises, the students had less time to think of and choose some key performance indicators and plan the activities for their business model. Consequently, the work on the KPIs had to be completed as homework, along with finalizing the business model canvas.
- **Day 8**. The next day began with a review of the canvas prepared by each team. As the progress made by each team was briefly described, we noted the involvement of the students, their growing courage to express opinions and give suggestions, their increased self-confidence, and a higher tolerance for failure and to constructive criticism. By sharing and discussing their work, the students acknowledged the progress made in understanding their own strengths and weaknesses and that the feedback received providing valuable perspectives that they had not taken into account. The second session was devised to inform the students of diverse financing opportunities available for both product development and start-up opening, with an emphasis on the national context. Although the students recognized the general relevance of the topic, they expressed reservations as the theme was presented too early, before their projects were mature enough to be concerned with access to finance. As homework, the teams were asked to draft their final presentation.
- **Day 9**. The ninth day started with a session engaging the students in a series of exercises to increase self-confidence and public speaking skills. It became apparent that some of those exercises ought to have been scheduled earlier in the course, and particularly before the customer discovery interviews. During the second session, the mentors assisted the teams in putting together a presentation based on certain basic guidelines. The template was meant only to ensure some minimal structure, and the teams had a great deal of freedom to express themselves and customize their presentations according to their own preferences and creativity. They completed exercises to synthesize the key aspects of their project and clearly specify the novelty of their idea. They negotiated roles and responsibilities during the preparation of the presentation as well as in its delivery since every team member had to be involved. They worked together, managing differences in opinions and searching creative ways to convey their message.
- **Day 10**. The last day of the course started with the project presentations. The five teams each had 10 min to convince the jury of the value of their idea. The teams addressed the problem and the particular set of clients, the technical solution, the

business model (including distribution channels, suppliers, estimated production costs, potential revenues and profit, etc.). A 5 min session of questions, answers, and comments allowed the jury to assess each project. The outcome of the final presentations was positive as all teams successfully presented their completed projects, delivering compelling arguments for their products and the corresponding business models. The last session started with a review of the course so that quantitative data on student progress and on student satisfaction could be collected, and it ended with a graduation ceremony where certificates were awarded.

5. Results

5.1. Research Questions, Instruments, and Sample

To evaluate the effectiveness of the course in improving perception and attitudes towards innovation and entrepreneurship, we constructed two equivalent questionnaires that were delivered before and after the summer school's activities as well as a questionnaire for measuring student's satisfaction with the learning experience. The main research question was "Following the course, is there an improvement in the student perception of knowledge, skills, and attitudes required for successful innovation and entrepreneurship?" A secondary research question was "At the end of the course, is there a change in the correlation between student perceptions of knowledge, skills, and attitudes essential for innovation and entrepreneurship?"

We designed the first instrument with three sections: *Knowledge*, *Skills*, and *Attitudes*. The questionnaire was applied on the first day of the summer school course and again, in an equivalent form, on the last day, which allowed us to track the students' progress.

To uncover how students perceive innovation and entrepreneurship, we extracted some relevant definitions and conceptualizations from existing literature [55,56], and we built two equivalent sets of items, as parallel forms of the same questionnaire. To ensure both conceptual and façade validity of the instrument, we asked peer experts to check the equivalence of the two questionnaires [38,39,57].

As our course was designed to help students acquire different types of knowledge (factual, conceptual, procedural, and metacognitive), the perception assessment questionnaire was conceived to align accordingly. We included items referring to factual knowledge [58] as well as conceptual knowledge [59]. Similarly, we formulated items to evaluate the perception of procedural knowledge, which is practical in nature and involves understanding of processes [60], and metacognition, which enables students to reflect on and self-regulate their own learning experiences [61]. The *Knowledge* section included 24 questions, divided into four dimensions: innovation in entrepreneurship, the entrepreneurial process, the professional tasks of an entrepreneur, and the creative process. Students had to assess the extent to which they agreed with the items on a Likert scale scored from 1 to 5.

The *Skills* section focused on the abilities necessary to be a successful entrepreneur: financial, market understanding, effective communication, active listening, strategic thinking, networking, negotiation, leadership, time management, and being an agent for change. We chose these variables as we considered them to be the basis for the development of skills that are needed by both entrepreneurs and intrapreneurs (employees that are drivers of business growth) [44]. To build this section, we documented the concepts and used scales from different established tests [62] after adapting them for the Romanian population [63]. For each skill, the task of the students was to indicate to what extent those skills are in their personal background and in their learning to date. This section was the same in both questionnaires.

The *Attitudes* section comprised a set of 19 misconceptions and myths about entrepreneurship and entrepreneurs that was inspired by existing evidence [64]. The goal was to identify the extent to which the perception of students about entrepreneurship is based on biased beliefs. The task of our students was to express their degree of agreement for each of the items, scored on a Likert scale ranging from 1 to 5, during both the initial and the final assessment.

Additionally, during the last day of the summer school, students received a *satisfaction* questionnaire with two sections. The first examined course organization and logistics, the quality of mentoring, the relationships between trainers and peers, and the quality of the various activities. Students rated their satisfaction in all four dimensions on a Likert scale ranging from 1 to 5. The second section of the survey was open-ended and asked about the strengths and weaknesses of the course, and ways to improve it.

The 31 students we selected were distributed as follows: 7 from engineering and computer sciences, 14 from business and law, 5 from arts and 5 from medicine. The gender distribution was balanced (16 male and 15 female students), whereas the distribution by academic cycles was more heavily weighted toward undergraduate students (28), with only few in master's programs (3). Of these students, 10 had attendance issues, and only 21 responded to both assessments, so these 21 became our research sample. The sample was purposefully chosen to be heterogeneous in terms of field of study. All students gave their consent to participate in this research, and the confidentiality of their answers was ensured.

5.2. Overall Perception on Knowledge, Skills and Attitudes

Our main research question referred to changes in perception regarding I&E knowledge, skills, and attitudes, reflected by positive differences in scores between the final and the initial questionnaires. To answer the question, we used the Mann–Whitney U-test for independent samples. The results are synthesized in Table 1.

Table 1. Results of initial and final assessments. Displayed are the minimum, the maximum, the difference between the extreme values, the average scores, the difference between averages, as well as the results of the Mann–Whitney U-test, performed with SPSS [40].

Variable	Assessment	Min Score	Max Score	Max-Min	Mean Score	Differences	Mann–Whitney U-Test	Sig. (2-Tailed)
Knowledge	Initial	3.292	4.833	1.541	4.127	0.381	107.000	0.004
	Final	3.500	5.000	1.500	4.508			
Skills	Initial	2.605	4.884	2.279	4.153	0.472	108.000	0.005
	Final	4.674	5.000	0.326	4.625			
Perceptions and attitudes	Initial	1.421	4.895	3.474	3.084	0.126	206.500	0.725
	Final	1.737	4.895	3.158	3.210			

The columns reporting the difference between the maximum and the minimum scores obtained by the students provide information regarding the width of the distributions of scores. We note that differences between the extreme values are smaller for the final assessment compared to the initial one, and that the differences between the average scores are positive. These results indicate an improvement for most students, particularly for those with initially lower scores. Similar trends can be seen for all three scales, with more dramatic changes for *Skills*. Comparing the scores between the three types of competences, we observe that highest and closest scores were obtained for *Skills*, whereas lowest scores and widest distribution was found for *Attitudes*.

The significance of the differences obtained can be analysed based on the data in the last column of Table 1. For *Knowledge*, the difference in average scores between the final and initial questionnaires is 0.381, whereas for *Skills* it is 0.472, with a confidence interval more than 99%, indicating a significant improvement. Finally, analysing the *Attitudes* variable, we note a smaller difference of only 0.126, which is not statistically significant ($p > 0.05$). In summary, the distributions of scores shifted towards higher grades for all dimensions. The statistical tests indicated robust tendencies for the perception knowledge and skills and a less conclusive trend for attitudes.

5.3. Results for the Knowledge Scale

Since the three main dimensions are complex, we considered useful to also test the differences obtained for the subscales of *Knowledge* and of *Skills*. Table 2 displays the results for the four subscales we chose for the *Knowledge* dimension. The largest increase in scores was obtained for the subscale on creativity, closely followed by the one on the entrepreneurial process. The smallest difference resulted for the subscales on innovation, which is the only one that fails the significance test, with $p = 0.062$ (>0.05). In this case, the number of items was smallest, which may affect the statistics.

Table 2. Results of initial and final assessments, for the subscales of the *Knowledge* dimension.

Variable	Initial Mean Score	Final Mean Score	Differences	Mann-Whitney U-Test	Sig. (2-Tailed)
Innovation in entrepreneurial process	4.233	4.556	0.322	148.000	0.062
Entrepreneurial process	4.020	4.457	0.437	122.500	0.013
Professional tasks specific to entrepreneurs	4.117	4.468	0.351	136.000	0.033
Creative processes in entrepreneurship	4.212	4.655	0.442	127.000	0.017

The average scores in the *Knowledge* dimension were all higher than 4, suggesting that the students had already been aware of the basic concepts and ideas involved in innovation and entrepreneurship. This may be caused by the way the sample was constructed, the selection criteria used favouring candidates with a specific mindset, open to innovation and creativity, regardless of their appetite for risk. Looking at progress, the subscale on the *Entrepreneurial process* displayed some improvements, as students were able to identify opportunities emerging from needs that are not satisfied, to work together and establish long-term goals and medium-term specific objectives, to design a business model around a strong value proposition to customers, etc. The course activities enabled students to set aims, plan, study, think creatively, analyse, make decisions, and implement changes, all these actions being key elements of an entrepreneurial endeavour [65].

For the subscale *Professional tasks specific to entrepreneurs*, we can state that by gathering information and relevant insight concerning potential customers, suppliers, and competitors, by making sense of financial documents, by managing human interaction in teams and with customers, students have attained a deeper understanding of what entrepreneurs need to do. However, still to improve are the issues related to risk taking and tolerance to failure, autonomy, and responsibility, etc.

Creativity was increased as students were encouraged to exercise their curiosity, imagination, and inspiration, to think unconventionally and accept new, unfamiliar perspectives. Repeated brainstorming activities, along with the better understanding of the criteria-based decision-making process contributed to building trust.

Rather puzzling is the inconclusive evolution of the subscale *on Innovation in entrepreneurial process*. The direct observations suggest an improved understanding of the innovation process, based on students' responses to questions and on their behaviour during course activities. Likely, these observations are rooted in the numerous and extensive design thinking exercises. Under these circumstances, we cannot rule out the possibility that the poor reflection of those advances in the scores might be due to a lack of clarity in the formulation of the corresponding items in the assessment questionnaire.

5.4. Results for the Skills Scale

The results of the data analysis for the I&E skills are shown in Table 3. We performed a similar t-test for independent samples, this time for a set of 10 subscales, each corresponding to a different entrepreneurial skill. The number of items for each subscale was more evenly distributed, which reflected in somehow closer *p*-values. The test scores showed improvement for all subscales but not all increases pass the significance tests.

Table 3. Results of initial and final assessments for the subscales of the *Skills* dimension.

Variable	Initial Mean Score	Final Mean Score	Differences	Mann-Whitney U-Test	Sig. (2-Tailed)
Financial planning	3.788	4.488	0.700	115.500	0.007
Market understanding	4.175	4.679	0.504	132.500	0.023
Effective communication	4.071	4.612	0.541	142.500	0.044
Active listening	4.250	4.524	0.274	158.000	0.103
Strategic thinking	4.250	4.508	0.258	175.000	0.240
Networking	4.025	4.595	0.570	136.500	0.027
Negotiation	4.050	4.695	0.645	91.000	0.001
Leadership	4.271	4.721	0.450	122.000	0.012
Time management	4.390	4.676	0.286	141.500	0.042
Agent for change	4.200	4.587	0.387	165.000	0.137

The increase in scores for the *Skills* dimension (Table 3) suggests an improvement on all subscales. The largest increase in scores was reached for financial planning, followed by negotiation, and networking, whereas the smallest increase was found for the strategic thinking and active listening subscale. In addition, the significance test is not passed by several subscales, despite the large differences. Likely, the experience of real-life situations played a role in enriching the entrepreneurial arsenal, whether the student aspired to become a good entre- or intrapreneur [66].

The largest increase in scores was reached for *financial planning*. The initial scores were rather modest, as from the diverse pool of students, not all possessed an advanced understanding of financial concepts. The course exposed the students to cost estimations, to basic pricing strategies, to revenue and profit appraisal. The games and simulations confirmed to be effective [67], exposing the students to financial notions in a low anxiety environment, where the peer-learning played a key role. The high increase in score observed for the students in fields other than economics was likely due to the strong interaction in their teams while, in turn, the business students also benefited from the experience of 'teaching' their colleagues.

The scores for *market understanding* skills show an improvement, probably linked to the involvement [68] of the students in several exercises for gaining empathy and building empathy maps, discovering customer needs, validating assumptions, testing solutions, checking commercial potential of their products, etc. Having the opportunity to conduct real market research, to interview beneficiaries, buyers, and stakeholders, to discuss experiences within the team, to analyse data and to draw conclusions were valuable experiences leveraging our students' marketing skills.

Effective communication and *active listening* are intertwined, but our score results indicate different progress and, more importantly, different significances of those improvements. The increase is stronger and more reliable for effective communication, as the students had to interact on different levels: with teammates, mentors, beneficiaries/customers, stakeholders, etc. The training exposed the students to situations in which they could practice their abilities to receive, understand, conceive, and deliver messages, confirming its potential to influence and change their behaviour [69]. The observations of the quality of communication between teammates seem to correlate with the effectiveness of a team [70].

Although statistically the progress in *active listening* is not significant, existing a clear possibility of being due to other factors, the direct observations do suggest some improvements. The exercises challenged the students to listen and understand one-another, to find answers from potential customers, to provide appropriate guidance or feedback, etc., in line with findings of other reports [71].

The students also improved their *negotiation* and *networking skills*. The exercises gave them opportunities to agree on roles and responsibilities, deadlines and deliverables, to deal together with challenges, and to settle disagreements. The students in business led the effort of building contacts, serving as examples for their teammates from other fields

in developing the interaction with possible customers, end-users, suppliers, competitors, etc. [72].

The scores for skills of *strategic thinking* and of being *agents of change* have improved, but the result cannot be equated reliably with the impact of the course, as the significance tests were not passed. As innovation and entrepreneurship are closely linked to strategic thinking [73], some of the exercises students were given challenged them to define a vision, clarify and customize a mission, set objectives, choose performance indicators, etc. The limited prior practice posed some pressure on the students but, gradually, they learned to identify needs and propose solutions, to assess progress and adjust goals, to test assumptions and modify plans. It should be noted, however, that these skills are complex, need a wider context and take long time to develop [74]. Our course attempted to offer a close to real-life learning experience, but it was still a simulation and within time constraints.

The *leadership skills* subscale showed more reliable growth. Faced with the challenge to make decisions, the students had to collect and review relevant information, to assess the reliability of that information and to build resistance to stress. Although the self-confidence, courage, moral beliefs, etc. varied widely from a trainee to another, the understanding of the leader's role and the recognition of its defining qualities showed some enhancement. The direct observation gives us reasons to believe that the training laid down the foundation for the ability to assume leadership roles.

The course exercises helped students develop their *time management* skills while working either on site or remotely on planning, implementing, and assessing activities pertaining to their projects. Moreover, the time constraints put extra pressure on the students, who had to practice self-regulation and self-discipline, to remain focused and use time effectively and efficiently, all traits of successful entrepreneurs [75].

5.5. Results for the Attitudes Scale

Moving on to the last dimension, *Attitudes*, we recall from Table 1 that the increase in this dimension following the course was small and lacked statistical significance. However, our direct observations of student behaviour and responses, based on the enthusiasm, determination, respect for diversity of opinions, etc. shown in class, suggest improvements that are more robust. Given the limits in resources allocated for the course, our registration process gave some priority to students with a mindset more open to innovation and entrepreneurship. Although our participants seemed to have a specific mindset, only few were truly interested in starting their own business, many students having a limited tolerance to risks and manifesting a preference for intra- over entrepreneurship [44].

5.6. Results for the Correlations between Scales

Our second direction of inquiry regarded the correlations between knowledge, skills, and attitudes both before and after the course. We used Spearman's rank-order correlation to analyse the strength and direction of association between two variables, which are either ordinal, interval, or ratio, as in our case. The null hypothesis was that there is no association between the two variables and the alternative hypothesis was that there is an association between the two variables. The results are shown in Table 4.

The correlation coefficients for the initial assessment have small positive and negative values, suggesting weak correlation. In contrast, the correlation coefficients for the final assessment are all positive and up to 0.934, indicating stronger correlations, with the three variables increasing together. Looking at the p values, we note that for the initial assessment the values are larger than 0.05, supporting the null hypothesis, whereas for the final assessment, the null hypothesis is rejected, in line with the value of the correlation coefficient. The largest correlation observed is between *Skills* and *Knowledge*, which likely, were the easiest to measure with our instruments.

Table 4. The values for the Spearman correlation coefficient, rs, and the probability associated with it, p, for the three dimensions, knowledge, skills, and attitudes, both before and after the course, performed with R [76].

Dependent Variable	Independent Variable	Initial Assessment		Final Assessment	
		r_s	p	r_s	p
Skills	Knowledge	0.32971	0.0807	0.93474	0.0000
Perceptions	Knowledge	−0.32349	0.08693	0.65322	0.00007
Perceptions	Skills	0.23198	0.22594	0.61444	0.00024
Skills	Knowledge	0.32971	0.0807	0.93474	0.0000

These results suggest that the learning process in the course managed to integrate students' knowledge, skills, and attitudes, allowing positive transfer between the three dimensions of competences. Transformative learning means that the processes of reasoning and decision-making are mediated by the skills that support efficiency, also being shaped by beliefs and a coherent body of experiences [77]. The direct observations made during the course showed that, during such interactive activities, the students were stimulated intellectually to understand I&E concepts, challenged to apply that knowledge and practice abilities, and encouraged to act based on profound values. Thus, our attempt to shape behaviour and help students develop ways to think, act, and feel coherently, agrees with other studies affirming that transformative integration is based on critical thinking, both reflection and self-reflection, and openness to change [78].

5.7. Results for the Satisfaction Survey

At the end of this section, we also report the results of the student satisfaction questionnaire. We processed the data in terms of mean scores and customer satisfaction (CSAT) scores [79], which was calculated as the ratio between the number of satisfied customers (awarding 4 or 5 points) and the number of survey responses, expressed in percentages.

The mean scores obtained were larger than 4.5 and the CSAT higher than 79%, for course organization and higher than 91% all other dimensions, indicating an overall satisfaction with the course (see the Supplementary Materials for details). Highly appreciated were the quality of the mentoring, the assistance and feedback from the instructors coming in a timely and helpful manner.

5.8. Results of the Final Examination

As stated in Section 3.3, the final assessment was complex and multicriterial. The evaluation of the project and final presentation was based on a rubric with several items, grouped in five categories: (i) innovative character and the added value of the technical idea, (ii) quality of the customer discovery outputs and of the minimum viable product, (iii) novelty and viability of the business model, (iv) overall quality of the design process, and (v) soft skills and values demonstrated by the teams in managing the project.

To make the evaluation less subjective the jury, composed of several recognized experts in the field of innovation and entrepreneurship, representing both the public and the private sectors, used rubrics as scoring guides, which described specific components and expectations for each criterion. For instance, when assessing innovation, they had in mind the degree of originality/novelty of the product/service designed and how it differs from the current solutions, with a strong focus on the added value. The quality of the customer discovery process was judged taking into account the two interview plans (the first for constructing the empathy map/avatar and the second to test the prototype and business ideas), the selection of the representatives of the chosen customer segment, the quality of the feedback collected from the potential customers, etc. The business models were appraised based on the viability and the potential to grow of that business, including but not limiting to the market potential (the size of the target market, the demand for the product/service, and the potential for scaling and return), cost structure and income

streams, distribution channels, etc. The potential social impact of the product/service was also judged, from perspectives of environmental sustainability, social responsibility, and ethical considerations. The soft skills required for a quality design process including curiosity, intuition, and empathy, creativity, unconventional thinking and problem solving, willingness to observe, passion for experimenting and prototyping, and perseverance, are all rather difficult to score. However, the rubrics helped not just the jury, offering some useful reference points, but also the students, raising awareness and contributing to a better understanding of the innovation process. Finally, the team dynamics were assessed based on the effectiveness of the communication and collaboration, on the time management, on leadership and execution, etc.

Examples of projects carried out and presented by the teams of students are the following:

- *Autonomous cleaning robot* is a modern technological solution designed to effectively and efficiently maintain the cleanliness and tidiness of certain areas. This robotic system is equipped with advanced sensors, artificial intelligence algorithms, and environmentally friendly cleaning mechanisms to provide a sustainable and autonomous solution to health care space maintenance. However, its use can be extended to various other spaces.
- *Smart pills dispenser* represents a healthcare device designed to facilitate medication management for individuals who require regular and precise dosages of medications. This intelligent dispenser combines advanced technology with user-friendly features to ensure a seamless and efficient medication administration experience.
- *Intelligent prosthesis for posture evaluation and correction* integrates biomechanical engineering, multiple sensors and artificial intelligence to address posture-related issues and provide real-time feedback for individuals with spine posture deficiencies. This innovative prosthesis not only supports mobility but also actively assists users in maintaining optimal posture, enhancing their overall comfort, health, and quality of life.
- *Smart shopping cart* represents an intelligent device able to enhance the shopping experience for consumers by incorporating a range of features to support convenience, efficiency, and engagement throughout the shopping journey. The cart features sensors and cameras that automatically scan items as they are placed in the cart, display for the shopping list and navigation assistance to guide users to the locations of desired products. It can be used in a supermarket-like pharmacy or various other shopping spaces.
- *Remote health monitoring system for elderly people* represents a platform that encompasses smart sensors for remote monitoring of health status, wearable devices tracking changes in mobility and balance, as well as strategies, methods, and installations that enable medical professionals to work remotely to consult, diagnose, advise and treat elderly people. The system cis able to manage many simultaneously requests and to trigger alarms in case events which endanger health status of the monitored people happened. The alarms are automatically ranked in priority by the system and the requested resources are dispatched.

6. Discussion

We reported the results of the assessment instruments in the previous section. Here, it is worth discussing them in correlation with the direct observations and the answers to the open-ended questions in the satisfaction questionnaire.

6.1. Student Feedback

While most students appreciated the 'provoking' nature of the course and its 'sustained pace', several expressed their desire to have had more time to absorb some key concepts and some considered that the succession of activities had been 'intense'. The students acknowledged the usefulness of the discussions and of the comments and suggestions

received from trainers as well as from the jury, teammates or colleagues in the thematic group, colleagues in other teams, etc.

Feedback that is slightly more appreciative was received from female respondents, who valued the relaxed atmosphere that encouraged interaction, whereas male students asked for improved infrastructure and components for building prototype robots. Several students recommended that a larger amount of time be dedicated to team formation and building, whereas others insisted on more time for technical and graphic design.

An interesting proposition was to have mentors assigned to each team, as the trainers focused on the work in subject-specific groups. Our approach had been to provide similar guidance and equal opportunities to all students and to encourage their autonomy and independence. While all students liked the freedom of choice, some would have appreciated more assistance. Our experience with another entrepreneurial training [42], taught us that the mentor has a major role in the success of the team.

A few students suggested that more time is dedicated to personal development and communication skills. While they appreciated the opportunities offered throughout the course, and particularly the exercises in the ninth day, they proposed that such activities are introduced earlier, as they played an important role in raising self-confidence and facilitating effective teamwork.

One challenge that was mentioned referred to some fluctuations in student participation. Unequal involvement and even quitting the course in one case produced disturbance in teams. While we made every effort to ensure team stability, constant attendance and continuous involvement, we also tried to help teams build resilience, acknowledging that real life does not shield from such instabilities.

Finally, some students suggested that innovation, entrepreneurship, and personal development courses like the one they completed ought to be included in a general, cross-disciplinary curriculum. Additionally, the participants expressed their desire that more classes are taught in a similar hands-on approach. Such comments strengthened our conviction that the present pedagogical experiment needs to be replicated and further developed and the expertise gained by the trainers transmitted to their colleagues.

6.2. Lessons Learned

To summarize the most important three lessons learned from the first edition of the course may be synthesized as follows.

Planning is important but flexibility is essential. The careful design of the course and of the student learning experience in particular are very important for success, as they create a framework for all activities. However, as the actual schedule may not be respected, flexibility and adaptability are key for effective implementation. In such instances, we need to return to the major goals, the enduring knowledge, skills, and attitudes that we promote, adjust course accordingly and respond to the real needs of our students.

Less may well be more. As students repeatedly asked for more time to absorb new concepts and to develop key skills, we learned about the importance of guided group discussions. It is true that allowing for fruitless discussions will run the clock out but, with proper guidance, they are more effective than teacher's presentations. If from the design phase, the enduring competences to be addressed are well defined, then, during the implementation stage, the choice of essential vs. secondary competences becomes straightforward.

Managing expectations and practicing empathy are crucial. Students come with various backgrounds, have different prior knowledge and skills, and may face diverse anxieties. Being aware of these differences, the trainers must practice active communication, patience, and empathy while facilitating the students' discovery. Paying attention to the social and emotional dimensions of learning paves the way for a memorable learning experience.

6.3. Limitations of Our Study

At the end of this section, we make a few comments on the limits of our study. First of all, the present research is an interesting and well documented case study and, as such, has no pretention of general validity. Another limiting factor is the number of participants. Although the course was specifically designed for a group of about 30 students and the average daily attendance was larger than 25, the fact that only 21 of them responded to both assessments, imposed constraints on the significance of some of our results. Additionally, although we tried to have an as diverse sampling as possible, the fact that we selected the participants based on specific criteria, not randomly, limits the validity for similar samples, and cannot be generalized.

Another limit of the study correlates with a limit of the training course itself, the summer school lasting only 10 days. In such a short period, it is difficult to demonstrate quantitatively the improvements in knowledge, skills, and attitudes, or the changes in students' perception of the competencies required for I&E. Some positive changes were noticeable to direct observation but problematic to prove with statistical significance.

Finally, some of the instruments we used for our measurements, particularly those built by the implementation team, ensured only the conceptual and façade validity. The reliability and the internal consistency of the measurements had not been statistically tested and validated prior to their use. We plan to improve these aspects in future experiences.

7. Conclusions

We reported the design, implementation, and evaluation of a project-based training course in innovation and entrepreneurship devised for a transdisciplinary group of students from engineering, social sciences, arts and medicine. The curriculum of the course was created using a backward educational design approach, starting from the learning outcomes, continuing with choosing appropriate evaluation tools, and ending with the planning of the learning experience. In setting the learning outcomes, we were careful to include all three dimensions of competences: knowledge, skills and attitudes, paying attention to Bloom's revised pyramid. The evaluation included oral questions during activities and a project evaluation based on a specially designed rubric. The planning of the learning experience was accomplished using the design thinking method, which stresses empathy for the end user, in a student-centred approach sensible to the social and emotional dimension of learning.

The ten-day intensive course was delivered to a multidisciplinary group of 31 university students, who worked in transdisciplinary teams to design a product (an autonomous mobile system for automatic monitoring and control applications in healthcare) and a business model for its fabrication and commercialization. The activities were carried out in plenary sessions, in thematic groups, as well as in teams of 5–6 members, with very little lecturing and a clear accent on student inquiry, in a learning by doing approach. Trainers of various backgrounds guided the students in their discovery and design journey.

Despite the limits of our quantitative study (related to the rather small number of students, 21, taking both questionnaires, to the non-random sampling of the participants, the short time allocated, etc.), we were able to conclude that our training course contributes to a positive change in student perception of competences required for successful innovation and entrepreneurship. The progress was recorded across all three dimensions of innovation and entrepreneurial competences, the Mann–Whitney U-tests performed to check the significance being positive for most subscales of knowledge, skills and attitudes. Moreover, the correlation analyses suggested that the course provided transformational learning as the hands-on experience allowed the students to integrate knowledge, skills, and attitudes, allowing positive transfer between the three dimensions of I&E competences.

Our direct observations showed overall student involvement. The "learning by doing" approach, the transdisciplinary character of the teams and collaborative nature of the tasks, as well as the focus on empathy and customer discovery, proved to be stimulating for the students. The pauses made for self- and group reflection on concepts and practices as well

as on the progress achieved helped them self-assess and motivated them to put more effort, in a friendly competition with their peers. Moreover, the satisfaction survey revealed a relatively high degree of satisfaction with the course design, organization, and logistics, as well as with the quality of the mentoring, the relationships with the peers and the trainers, and the quality of the exercises and activities performed.

Three major lessons resulted from the course. First, we acknowledge the importance of planning but strongly emphasize the need for flexibility, as there are times when the initial schedule cannot be respected. Second, we verified that less might be more, as students repeatedly asked for more time to discuss and absorb the new concepts and to develop key skills. Third, we noted that managing expectations and practicing empathy are crucial. Care for the social and emotional dimensions of learning may pave the way for a memorable learning experience.

Thus, we have reasons to believe that our main goal of introducing students to innovative design techniques as well as to entrepreneurial approaches, thereby assisting them in developing necessary knowledge, skills, and attitudes for transforming an idea into a technical solution and developing it into a business model, was achieved. Our secondary goal was to prepare a core group of academics in planning and executing an inspiring project-based learning experience for their students. The design thinking exercises used in preparation for the course to formulate the learning outcomes, to conceive the rubrics for project evaluation, and to choose or develop practical exercises for the actual learning experience proved inspirational and provided good practice. During the implementation phase, the trainers were able to better empathize with their students, having passed through a similar experience. Additionally, the interaction was bidirectional, with both trainers and students taking part in a learning process and acting as co-investigators. Moreover, the assessment phase was also insightful, providing feedback on effectiveness, revealing strengths and weaknesses of their endeavour.

Finally, as a ten-day boot-camp is rather short for students to reflect and note changes in their attitudes, we are exploring ways to follow up and see how students further change their perception of innovation and entrepreneurship and consolidate the competences acquired. A follow-up study could provide additional data on the effect of the course on creativity, empathy, active listening, risk taking, and other skills and attitudes relevant to I&E.

We believe that our results are encouraging, and we hope that the description of our educational experiment can provide some useful landmarks for designing, implementing, and assessing transdisciplinary project-based learning activities. Although the present study is focused on innovation and entrepreneurship, we consider that its relevance is much broader, and it could be helpful for educators interested in curriculum design or in pedagogical innovation.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/educsci13100967/s1, Table S1: Schedule of the 10-day intensive course; Table S2: Examples of exercises; Table S3: Details of the activities performed in the subject-specific workshops organized for the thematic groups; Table S4: Quantitative analysis of the student satisfaction questionnaire, providing mean scores and the customer satisfaction score.

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