C-EXTENDED: EXTENDING THE ERASMUS EXPERIENCE BEYOND MOBILITY

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Abstract

The EU innovation effort to address grand societal challenges is facing an increasing divide. The C-Extended Erasmus+ Strategic Partnership project has the vision to help join this divide by extending the Erasmus experience beyond geographical mobility. It aims to enable stronger contamination between diverse knowledge domains on the one hand, and to foster tighter cooperation between higher education institutions and public/private organizations on the other hand. To this end, mobility opportunities have been explored and piloted through a new mobility scheme, called IIBMS, that results from evolution of existing programmes combined with blended learning, in order to engage students in interdisciplinary and intersectoral educational paths. This paper presents this scheme and discusses the rationale of the design, the current state of development and the prospective outcome of the project.

Keywords: Erasmus, blended learning, interdisciplinary education, virtual mobility.

1 INTRODUCTION

The need to boost innovation in the European Union (EU) finds one of its major obstacles in the shape of its Higher Education (HE) system which, although considered the key knowledge engine of Europe [1], is still fragmented [2] and requires to undergo a deep process of modernization in order to tackle an increasing intra-EU innovation divide [3].

In this context, one of the main intervention logics has been the promotion of transnational cooperation both in research (mainly, framework programmes) and education (mainly, with the Erasmus+ programs) [4]. However, while research is directly supported at the level of EU governance, education, being a full Member States (MS) prerogative, requires to be supported in a stronger bottom-up fashion enabling individual MS and Higher Education Institutions (HEIs) to explore transnational collaboration opportunities [5][6]. In this effort, mobility plays a pivotal role. It allows to pull together competences and resources without draining local and regional knowledge ecosystems, which are essential in conjugating excellence with cohesion, securing a distributed landscape of talented human capital, synergetic resources and maintaining a local absorptive capacity. In a nutshell, such a trade-off can be addressed when human capital can be moved rather than drained.

However, mobility goes beyond the transnational dimension. It has been long observed that innovation lies at the boundaries between different knowledge domains, where discontinuities can spark [8][9]. This observation clashes with a HE system in which intra and inter-institutional barriers are the norm, framing scientific knowledge into silos and departmental logics. Moreover, it emphasizes the need to enable new forms of interdisciplinary mobility, allowing for a stronger contamination between diverse knowledge domains, following the increasing focus of the EU innovation effort on societal challenges, which are clearly interdisciplinary in nature [10].

From another perspective, the divide between the academic and business/social sectors has been often emphasized, translating in a weak capacity to transform ideas into tangible value and ensuring a bi-directional knowledge flow by means of intersectoral mobility. In this sense, there is a clear need to foster a stronger cooperation between HEIs and public/private organizations [7].
In this paper, we present the “C-Extended” Erasmus+ Strategic Partnership project. This project aims at contributing to the EU effort in overcoming borders in HE, exploring mobility opportunities beyond a geographical dimension. We thus present how the C-Extended project pursues this vision by designing, testing, monitoring and evaluating an Interdisciplinary/Intersectoral/Blended-Mobility Scheme (IIBMS) targeted at the moment to Master’s level students. We also illustrate how the project aims at piloting this scheme through the mobility of 30 students coming from a core ICT domain. These students are offered to undergo, transnationally, an interdisciplinary pathway, engaging also in an intersectoral experience, all supported by blended learning.

In the next sections we present and discuss some details of how the project views mobility as that occurring from theory to different theory (interdisciplinary) and from theory to practice (intersectoral) while exploring new opportunities to complement and conjugate the needs of students in mobility by means of blending learning. We will finish by discussing the results obtained so far.

2 INTERDISCIPLINARY-INTERSECTORAL-BLENDED-MOBILITY-SCHEME (IIBMS)

Our C-Extended project aims at supporting the evolution of existing mobility programmes to a level in which mobility is seen as the opportunity to engage students in interdisciplinary/intersectoral educational paths, achieved also by exploiting the opportunities offered by blended learning. To start designing, implementing and piloting such paths, we have initially focused on mobility at the Master level, when students have already completed the first level of higher education (bachelor’s degree) and are seeking specialization and alignment with their future jobs.

Currently, the typical Erasmus+ mobility for two-years Master’s students (Fig. 1) occurs in the second or third semester. Students participate in mobility to take courses in the same discipline that they are studying, but they frequently face issues in mapping the required courses from their home universities to their host universities.

The typical Erasmus+ mobility creates significant overheads in the negotiation of the Learning Agreement, or the need to take courses that will not be easily recognized at the home institution. Once the students arrive at the host university, furthermore, it may happen that they will face conflicting time schedules, or find courses that don’t match their level of preparation (too advanced or too basic). All of these factors usually lead to an undesirable outcome: the mobility experience that the students undertake ends up prolonging their overall study programme, leading to delayed graduation, as it is recognized by Erasmus+ itself.

We aim at solving these problems by introducing three new types of mobility: Interdisciplinary; Intersectoral; and Blended. Each of these dimension is discussed extensively in the following sections,
so here only some cursory definitions of these three dimensions will be provided. The overall integration of the proposed framework is shown in Fig. 2.

![Diagram](image)

**Fig. 2: Proposed C-Extended student mobility (1 semester) at Master level.**

**Interdisciplinary** (ID) mobility is seen as occurring when the student is exposed to education pertaining to a discipline which is not his/her core study field. We call the target discipline “off-discipline”, which configures the ID mobility as something akin to a minor. ID mobility provides to the students with the basics of another field, broadening their horizons and enhancing their education. Ideally, the ECTS for ID courses would come from “free choice” credits in their curricula. In our scheme, ID mobility is done during geographical mobility.

**Intersectoral** (IS) mobility is seen as occurring when the student temporarily exits academia to go to another sector of activities such as research institutes, companies, NGOs or public administrations - often for an internship. In this way, students have the chance to experience how their career might look like after their graduation. IS mobility also has a geographical component (at least in our pilot), and should leverage as much as possible the internship periods embedded in the curricula.

**Blended** (B) mobility provides the “glue” to complement and strengthen ID/IS mobility through the use of online and blended education. Online modules on soft/transversal skills can be used on-demand to enhance the student’s contextual awareness of where they are operating during their IS mobility. Modules on the off-discipline, instead, can help in the preparation for the ID mobility and in its follow-up. Remote coaching is also seen as a strong option to aid the ID/IS mobilities. Blended mobility does not inherently have a geographical component.

These mobilities imply the direct participation in the IIBMS of four classes of actors: (1) Master’s students; (2) Main Discipline teachers; (3) Off-Discipline teachers; (4) Organizations offering intersectoral mobility.

Students are ideally recruited in their third year of Bachelor’s, so that they can experience the IIBMS for the whole 2 years of their Master’s degree. Alternatively, first year Master’s students can also be recruited. This double track recruitment allows for greater flexibility and does not require students to commit to a whole Master’s in mobility while still in their Bachelor’s, but trades off the completeness of the experience.

Teachers need to be - at the very minimum - informed about the existence of the IIBMS, but can be involved more deeply in the design of interdisciplinary paths, the recruitment of companies for the intersectoral experiences, the identification of adequate online learning content for the blended mobility, and the coaching of students at any stage of the IIBMS.

Organizations hosting students during their IS mobility also need to be aware of the specificities of the IIBMS. Ideally, they would also work with teachers to propose experiences that maximize the learning
for the student, and the added value for themselves, making use of the student's knowledge both in its depth and breadth dimension, asking support when needed from the University coaches.

The IIBMS, however, also requires the indirect participation of other actors. These actors allow the scheme to succeed, and enable its smooth execution. University personnel such as project managers, administrative personnel and high-level decision makers all fall into this category.

At the turn of the decade (and of the Framework Programme), we feel that Erasmus has the opportunity to embrace further its educational mission. The current framework has many benefits, one of which is its "lightweight-ness". Other experiments piloted through Strategic Partnership projects and larger EC-sponsored initiatives such as the EIT show that the concept of mobility can indeed be pushed forward to increase its educational power. The core expertise of our partnership, ICT, was a background in which this potential was particularly clear, and at present informed the choice of the three dimensions that compose the IIBMS.

ICT has an innately interdisciplinary calling, since it is often used as an enabler to other scientific and business activities. Thus, students in this field greatly benefit by knowing the *modi operandi* of other scientific disciplines [cit]. This allows them not to be confused if they are to work in a non-pure ICT company, and be more incisive when working in interdisciplinary teams, be it in a company, in a research institute, in academia or anywhere else.

This intersectoral dialogue, however, is one in which Europe sees some latency compared to the US and Asia. The skillset of students - and their technical expertise - needs to be transferred more easily from academia to other sectors and vice versa. Therefore, the competences of the students need to be honed with this goal in mind.

Universal geographical mobility is however environmentally and economically unsustainable, and this is where virtual (or better, blended) mobility comes in the picture. The online space has a strong "meta" valence in the ICT context, since it is powered by those same technologies. Educational research in online learning seems to suggest that the potential of these learning space is still untapped, and the extension to the concept of "virtual mobility" in the Erasmus setting seems a natural stepping stone in this direction.

This vision, however, needs to be tuned and aligned in one direction, which can be identified by the setting of appropriate high-level overarching learning objectives of the IIMBS.

3 INTERDISCIPLINARY LEARNING MODULES DEVELOPMENT

In the first part of the project we have focused mainly on the development and structure of reusable Interdisciplinary Paths (IPs) in selected Off-Disciplines at each of the participating universities. The selection of the IPs has been based on a three-dimensional analysis considering:

a) effectiveness of the IP in the context of the specific off-discipline pathways learning outcomes (LOs);

b) availability of existing learning modules that, in some cases through upgrading and updating activities, can be used/combined/transformed into an IP;

c) availability of existing blended contents, methods and tools for exploitation within and beyond the existing partnership.

After a period of discussion and analysis among partners during the first year of the project, the choice of off-discipline areas has been:

a) energy transition and digitalization/energy and climate (in short: EC: Energy-Climate);

b) socio-economic/innovation and entrepreneurships (in short: SE/IE);

c) bioinformatics (in short: BI).

Seven IPs have been developed and are being offered during the second year of the project, constituting on average 4 courses per IP. Eventual prerequisites competences and continuous support on the main learning objectives of the IP are supported by blending methods and online material made available to students by the participating HEIs.

More specifically, the seven developed IPs are: (1) Complex Systems Engineering at TU Delft; (2) Engineering Design at TU Eindhoven; (3) Smart Grid and Power Networks at Imperial College; (4)
Energy Technology at KTH; (5) Innovation and Entrepreneurship at University of Rennes1; (6) Bioinformatics at University of Trento; and (7) ICT Innovation & Entrepreneurship at University of Trento.

All IPs have similar structure: they cover two semesters in order to support an appropriate courses offer depending on the student's mobility period choice; students are proposed to follow 2-3 the interdisciplinary courses offered in each semester and then complete their 30 ECTS semester with courses to be selected from the offer in their main discipline in the particular semester of their mobility. For each IP, a set of Overarching Learning Objectives (OLOs) and Intended Learning Outcomes (ILOs) is also provided to give a holistic structure to the IP beyond being a collection of courses. The details of each IP are collected and published in the project website¹ and have been shared with students in a number of Info Days at each participating institution.

As an example of one of these interdisciplinary paths, we present in the following in some details one of them, namely ICT Innovation & Entrepreneurship at University of Trento.

3.1 IP Example: ICT Innovation & Entrepreneurship at University of Trento

The proposed IP is based on EIT Digital I&E Education experience. As such, it inherits the main goal of enabling students to become innovators and exercise entrepreneurial skills in all industries impacted by digitalization, beyond purely ICT. This interdisciplinary element is harnessed to create the path for the C-Extended project. Specific to UniTrento is the strong contact with the local innovation ecosystem, made by SMEs and public administrations, with which the University has strong collaborations.

Educationally, the path focuses on the delivery of business and entrepreneurial concepts to complement technical notions. Furthermore, the I&E interdisciplinary path also sets the development of “soft skills” as part of its OLOs. Internships related to innovation in products and services are offered at UNITN in local and national IT companies, start-ups and applied research laboratories.

The proposed IP is organized in two semesters and its schematic organization and offered courses are shown in Figure 3.

The Overarching Learning Outcomes for the ICT I&E path, based on the EIT Digital OLOs, are the following:

OLO 1. Value judgments and sustainability competencies
   - The ability to identify the short- and long-term future consequences of plans and decisions from an integrated scientific, ethical and intergenerational perspective and to merge this into a solution-focused approach, moving towards a sustainable society.

OLO 2. Entrepreneurship skills and competencies
   - The ability to translate innovations into feasible business solutions.

¹ https://sites.google.com/unitn.it/c-extended/home/about-the-project/interdisciplinary-activities
OLO 3. Creativity skills and competencies
- The ability to think beyond boundaries and systematically explore and generate new ideas.

OLO 4. Innovation skills and competencies
- The ability to use knowledge, ideas and technology to create new or significantly improved products, services, processes, policies, new business models or jobs.

OLO 5. Research skills and competencies
- The ability to use cutting-edge research methods, processes and techniques towards new venture creation and growth and to apply these also in cross-disciplinary teams and contexts.

OLO 6. Intellectual transforming skills and competencies
- The ability to transform practical experiences into research problems and challenges.

OLO 7. Leadership skills and competencies
- The ability of decision-making and leadership, based on a holistic understanding of the contributions of higher education, research, and business to value creation, in limited sized teams and contexts.

The Intended Learning Outcomes, instead, state that at the end of the path, students will be able to:

• Analyse the different perspectives on I&E and critically assess future scenarios;
• Understand the main decisional models and apply them to analyse real cases;
• Evaluate the impact of an innovation on organizations and society at large;
• Critically assess the impact of innovations as a tool to create a common consensus;
• Critically assess value propositions with respect to their relevance in the market and in society;
• Present and defend their ideas in public;
• Positively work in a group, managing deadlines and internal group dynamics.
• Have the ability to apply, synthesize, and evaluate prior I&E learning within a specific innovation or entrepreneurial project setting and a specific innovation area.
• Have the ability to conduct a business analysis, make decisions and formulate recommendations or justify actions in a real environment.
• Have the ability to choose and apply relevant concepts/methods and/or tools and collect relevant data for conducting a business analysis and making decisions in a real environment.
• Have the ability to produce a professional writing on a business analysis topic.
• Have the ability to apply concepts, methods and tools pertaining to identifying and assessing the impact/value of a technology in an industry, market and/or organization and the innovation / business opportunities it creates.
• Have the ability to reflect critically on issues related to the development of ICT solutions, and their potential pitfalls due to market and/or social reasons.
• Have developed a sense of "out of the box thinking" and creative approaches to problem solving, even in contexts that would otherwise suggest a technical solution.
• Have the ability to make value and ethical judgements about the development of technological and business solutions.

4 INTERSECTORAL LEARNING EXPERIENCES DEVELOPMENT

In order to prepare graduates for employment, intersectoral aspects needs to be considered. The aim of the intersectoral development is to take the students out of the academic environment and enable them, within the timescale of their degree, to experience an assignment in an industrial environment. The goal is to prepare students for work in the industry in a way that is still grounded in the fundamental principles of higher education.

According to our analysis, the basic principles of higher education in creating opportunities for students to become more familiar and confident when seeking for a job in the employment market are:
1 Clear definition of learning outcomes (LOs) with effective assessment strategies that must be aligned to these learning outcomes. LOs and assessments need to be student centric in order to ensure their usefulness in the students’ development.

2 A safe environment to set up work experience. This has two aspects: (a) a reliable employer who understands and sponsors the basic principles of intersectoral training and coordination within an academic setting. The safe environment relates to quality assurance of the industrial partners; (b) health and safety aspects related to the workplace that is outside the traditional remit of an academic environment.

3 Building of support system within an academic setting that prepares and encourages students to take the initiative to apply for internships. These aspects include for instance, guidance on CV writing and interview skills.

Intersectoral experience is working for industry on an industry-defined task with work ethics and independence set to industrial standards. The way in which this is implemented can be seen as more diverse than a student working in an industrial environment. The setting and approach towards solving the industrial task can show some flexibility in order to increase opportunities and diversity.

This definition leads to the following three types for intersectoral experience that will be offered to students’ in the C-Extended project:

1 Industrial placement – the student is integrated within a team in the company. For the intersectoral experience movement across country borders will be required.

2 Industry-led consultancy project – a team of students is invited to work as consultants on a problem set by industry but carried out on the academic premises. In the intersectoral approach this would mean that students from different partner institutions build a team, leading to diversity and a need for excellent communication skills.

3 Industry-set research project – one or more students work within a partner institute on a research question set by industry. Important here is the student mobility to another research institute to work on an industry-relevant project.

In the following development of the project we will develop effective guidelines based on the experience of consortium partners who have, as part of their curriculum, industry-related modules. It is recognised that each partner and more generally each Higher Education Institute (HEI) has its own character and vision. Therefore, the guidelines should only form a common ground on which to develop intersectoral student experience across HEIs and thus variations of approach are expected. This method will increase diversity and strengthen the overall approach by sharing of good practice.

5 APPLYING BLENDED LEARNING IN IIBMS

One of the components of the Interdisciplinary/Intersectoral/Blended Mobility Scheme proposed in C-Extended foresees the development and use of effective blended/online materials and approaches to support students to acquire fundamentals in their off-discipline before their interdisciplinary mobility.

The foreseen blended/virtual mobility requires - other than the provision of high-quality content - the involved HEIs to award ECTS for work that students carry out in online/blended form. In this respect local procedures and practices are at different maturity levels.

Level 0: Use the current teachers and supervisors of students to stimulate the use of online material based on the expertise of these supervisors. In a lot of interdisciplinary student challenges, or student internships at companies, multi-disciplinary knowledge is required heavily, either in the application or in the cooperation with (and understanding of) other experts. A truly well understood solution is supported by team members that understand the solution and can explain it to others. An intern should be part of the team.

Encountering knowledge gaps and difficulties in understanding other experts in other disciplines can be tackled by following openly available online education. The academic supervision (maybe company supervision could help) should guide in finding the right quality material, judging on the university and teacher reputation but more importantly on the content itself.

Currently this is already possible and students are already taken the initiative to follow courses online. However, students should be guided by supervisors who should evaluate online courses and share the results.
Level 1: extending the student’s Erasmus+ INterdisciplinary Paths mobility to include online/blended content. The IIBMS relies on the assumption that a student does 30 ECTS during their 6-months ID mobility and some preparation/follow-up credits (6/12) through Blending. This makes the formal duration of the mobility to more than a semester and more than 30 ECTS. A possible solution is to activate two mobilities, one physical, one virtual with the same HEI. The host HEI should award ECTS for the online content and provide completion certificates as well as ECTS accreditation to the sending HEI.

Level 2: activating mobilities towards multiple host universities: one for physical mobility and one (or more) for online mobility. Level 1 relies on the assumption that the student will do the physical and virtual mobilities in the same HEI. Some HEIs in our consortium (all of which obviously allow physical mobility) do not contemplate the possibility to award ECTS for online content. A possible solution is that each student opens more than one mobility: one for 30 ECTS for the physical (“interdisciplinary”) mobility and one (or more) mobilities for the online/virtual courses. This requires the creation of a consortium-wide agreement stating that the consortium shall award ECTS for online content accepted by any one of the partners (e.g. if TUD awards ECTS for an Introduction to Energy Engineering MOOC done by Berkeley on Coursera, a student from Trento can take the MOOC and receive a certificate from TUD even if she/he is attending KTH for their physical mobility).

Level 3: network-wide common recognition of online content. Level 1 and 2 have a high administrative overhead because of the multiple mobilities, and still rely on 1:1 agreements between the HEIs. A potential solution could rely on the commitment that each HEI shall recognize “sending HEI” ECTS for any online content which another HEI in the consortium recognizes (e.g. if TUD awards ECTS for an Introduction to Energy Engineering MOOC by Berkeley on Coursera, a student from Trento can take the MOOC and get credits as if he/she made the course in Trento. This needs the creation a consortium-wide agreement and common pool of recognized courses.

An incremental approach has been discussed and is under development for the implementation of the blended learning component of the project.

6 CONCLUSIONS

The final purpose of the project C-Extended is to develop a general framework for how to work with IIBMS in general, i.e. how to design and develop such paths in order for them to be reusable both for the delivery of new modules in the selected off-disciplines and for the development of paths in new off-disciplines in order for the project results to have an impact also after the project is finalized. Current work in the first part of the project has focused on the specific design, development and implementation in each participating HEIs of at least one IP. Based on this exercise and experience, our next effort will be to extract a general framework and guidelines.

The central goal of the C-Extended is in fact to boost the exploitation and extension of the project results after the EU funding, both enlarging the partnership and addressing new HEI networks. This goal provides a strong boost to disseminate the solutions, best practices and the main encountered criticalities to the interested new HEIs and HEI networks.

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