

The MEM project: experiences, challenges and outcomes of an international double master-level degree

Montanari, Roberto ^a; Abdel-Malek ^f, Layek; Andrei Paolo ^b; Ferretti, Gino ^a, Valenti, Simonetta ^c; Maria Mancinelli, Luca ^e; Bernazzoli, Alessandro ^d; Bottani, Eleonora ^a, Bloom, Joel S. ^h; Deek, Fadi P. ^g

^aDepartment of Engineering and Architecture, ^bDepartment of Economics and Management, ^cDepartment of Humanities Social Sciences and Cultural Industries, ^dInternational Division ^eUniversity of Parma, Italy. ^fDepartment of Industrial and Manufacturing Engineering, ^gDepartment of Informatics, ^hNew Jersey Institute of technology, USA.

Abstract

Educating the workforce of the future to perform adeptly in the global environment as well as to surmount cross cultural boundaries is of a paramount necessity in today's technologically advanced and complex settings. This environment has led institutions of higher education to seek international collaborations to face these challenges. Building on experiences and successes gained from a nearly decade long project entitled UMANE that was jointly supported by both the US Department of Education and the EU for undergraduate double/triple Bachelor's degrees, this paper reports on an extension of the earlier partnership, to include a graduate level partnership that offers a double master degree between New Jersey Institute of Technology (NJIT) and University of Parma (UNIPR) that was put in place in 2015.

In this work, we present the developed framework of this international cooperation, report on its challenges, and share our experiences. Specifically, the framework of the agreement establishes guidelines and course of study leading to double master degrees in the area of Engineering Management, one from NJIT and another from Parma University. Students in this program, usually, start their studies in Italy, attending the classes at their home Institution and then move to Newark, New Jersey, during the spring/second semester (6 months) of their first year, to attend NJIT classes. At the end of their studies, students will be awarded two master's degrees in Engineering Management from the partnering universities.

Keywords: *Double Degree, Internationalization, Engineering Management Education*

Literature Analysis

By doing a search on the Scopus database, using the keyword "Double degree", and including: only articles written since 2014, and having the main focus of the field of engineering; only 6 articles are considered that deal with initiatives aimed at achieving different Master Degrees in collaboration with different universities (Bakholdin et al., 2015; Biesenbach et al., 2016; Gnatov et al., 2017; Ishikawa et al., 2016; Bernabeu et al., 2016; Rawashdeh et al., 2014). It follows that the initiatives aimed at achieving double degrees at different universities are currently pioneering activities. Therefore, since the literature is lacking in contributions, it would be necessary to commit more resources towards the development and implementation of these programs, since the benefits deriving from them benefit both universities and students.

1. Introduction

Today, graduating engineers have to work and interact in a global environment. Cognizant of this fact, many institutions of higher education offer study abroad programs, joint undergraduate degrees, as well as dual or double degrees. One of the major goals of such programs is to expose graduating students to different educational, cultural, linguistic, managerial, and operational environments. Nevertheless, some of these programs are easier to implement than others (Malek et al., 2014). Although the undergraduate programs are less accommodating than their graduate counterparts, because of accreditation concerns, UNIPR and NJIT have had a long-standing cooperation since 2010. Through an award from Erasmus and the US Department of Education, these two institutions, in addition to Valencia Polytechnic University, developed double and triple degree bachelor's programs where they have graduated around 50 students that enjoy successful careers. Capitalizing on the experiences gained from this award a new collaborative project has been launched to focus on a graduate education, a Master in Engineering Management (MEM). In this paper, we discuss the development, evolution, and challenges of the MEM international program. The organization of this work includes, in addition to this introduction, several sections such as the project's Memorandum of Understanding (MoU) among the participating institutions, the study plan, benefits and difficulties that had been faced and overcome, and concluding remarks.

2. MEM Proposal and Memorandum of Understanding

The MEM project provides students with an opportunity to receive double master degrees from the University of Parma (UNIPR) and New Jersey Institute of Technology (NJIT). The participating institutions are collaborating with one another on a non-exclusive basis in the development of several master-level degrees in engineering, starting with a Master of

Engineering Management (MEM) dual degree program (MoU, 2015). The sending institution is primarily responsible for the recruitment, selection, and academic advising of its exchange students. Moreover, it currently assists in their cultural and language preparation. The sending institution also assesses and transfers courses taken at the receiving institution by the exchange students. These credits are used toward satisfying the sending institution's degree requirements. Exchange students from the sending institution normally study at the receiving institution for a period not to exceed two semesters (one year). The receiving institution also works reciprocally toward recognizing courses taken at the sending institution by the exchange students and assigning transfer credits to such courses taken. Similarly, these credits are counted toward satisfying the receiving institution's degree requirements. To be clear, while exchange students are physically at the receiving institution, satisfying requirements for their sending institution's degree, they are considered enrolled at the receiving institution and considered as non-enrolled but maintaining registration at the sending institution and vice versa. The aim of this project is to launch and advance academic exchange and cooperation in the general field of engineering, starting with Engineering Management. Students participating in the Program complete at least 30 semester credit hours, obtaining minimum of fifteen (15) of the required course credits for the degree from their home institution and at least fifteen (15) credits from the other institution. Upon successful completion of the remaining host institution courses, the credits from each participating institution are transferred to the other participating institution to satisfy the degree requirements at each institution. Among other goals of this collaboration are improving the level of transnational expertise and competences of European and American students, enhancing job opportunities, competitiveness, cultural exposure, and language skills (Malek et al., 2014). Moreover, the MoU includes the objectives:

- Develop an institutional basis for cooperation and exchanges.
- Develop Master of Science in Engineering degree programs, starting with the field of Engineering Management. These programs would advance the expertise and competences of participating students from both the EU and the US.
- Increase employment opportunities for graduates of the joint degree programs, due in part to global exposure, industrial participation, and the content of courses from different and high-specialized programs in multiple universities.
- Improve the proficiency of students in foreign language(s) and their appreciation of multiple cultures.
- Facilitate operation of participating students and faculty in different international environments.
- Exchange students between the participating institutions.
- Exchange faculty members between the participating institutions to facilitate the programs as well as enhance research collaborative efforts.

Monitoring students' progress is of paramount importance to the program. There are at least two advisors attending to each of the participating students advancement. Among others, their main tasks are to coordinate the institutions' requirements both technically and administratively. The technical and administrative coordination addresses and resolves pertinent issues that may arise during the term of this project. The advisors also facilitate supervision and reporting on the activities conducted within the framework of the double master. The project is currently in its second year. Students that join the program are motivated by the fact that they graduate with two master's degrees from both countries almost at the same time period. To be selected, exchange students must meet several criteria such as academic record; language fluency as determined per the circumstances and needs of each program; financial means of support available while taking courses at the receiving institution; relevant and appropriate curricular interests; and other criteria that the participating institutions may mutually require.

3. The Study Plan

Naturally, students in the program take courses at both institutions (See Figure 1).

Mobility:	UNIPR students		Main activities
Year 1	Semester 1: (October- December)	Learning at home institution	<ul style="list-style-type: none"> Learning EN language training
	Semester 2: (January- May)	Learning at NJIT	<ul style="list-style-type: none"> Learning Class assignments
Year 2	Semester 1: (October- February)	Learning at home institution	<ul style="list-style-type: none"> Learning Finals Exams
	Semester 2: (March- June)	Learning at home institution	<ul style="list-style-type: none"> Learning Joint Thesis Project Finals Exams Graduation Award of Master's Degree

		UNIPR students	USA	Main activities
Year 1	Sem. 1	Departure required early January	NJIT	<ul style="list-style-type: none"> Learning EN language courses for IT students
	Sem. 2	Repatriation expected by the end of May	NJIT	<ul style="list-style-type: none"> Learning Finals exams at NJIT and Finals exams at UNIPR after repatriation
Year 2	Sem. 1			<ul style="list-style-type: none"> Learning Finals exams at UNIPR
	Sem. 2		Possibility to join Commencement Ceremony at NJIT	<ul style="list-style-type: none"> Learning Joint Thesis Project Finals Exams at UNIPR Dissertation Award of Master's Degree

Figure 1. Mobility Program

However, due to the different educational systems, the number of academic credits must be converted from US program to the EU program and vice versa. It is therefore important to coordinate an academically balanced program, including the length of the courses offered by the different universities and the workload of the programs. There are some established patterns to follow regarding degree equivalencies:

- In Italy, master's studies are 120 credits for 2 years, 60 per year. Exchange students have to complete 90 European Credit Transfer System (ECTS) credits for one year and a half to earn the degree. ECTS credits in Europe correspond to 24 hours of a student's work; one third of these hours (8 hours) are covered in class.
- In the US, a conventional master's degree is approximately 30 credits earned typically over a year and a half. A one credit corresponds to one hour/week of in-class lessons for roughly 15 weeks. Hence, approximately 1 credit in the US system corresponds to about 15 in-class hours of a student's work.

Thus, the equivalence between the US credits and the European credits is 3 US credits = 6 ECTS (Mora & Montaner, 2014). In this way, 90 ECTS plus 30 American credits make a full 120 ECTS. However, it is important to note that cases are also addressed on individual basis. Another factor considered is the difference in the grading system. In the US, grades are specified using letters (A, B, C, ...). In Italy, grades are out of 30-point total of, and the minimum grade required for passing is 18 points. In addition, attendance is not required to pass the courses. That may differ from the US where class attendance may be required. There are concordance tables to transfer the grades among the universities (see Figure 2).

GRADES CONVERSION TABLE AMONG ITALY AND U.S.A.													
ITA	30	29	28	27	26	25	24	23	22	21	20	19	18
U.S.A	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E+	E

Figure 2. Conversion table of academic grades among the countries

To achieving the degree, specific core courses for each degree are need to be taken in addition to electives one. Due to natural overlap in these courses, and because some courses may not be offered when the students need them, one challenge in this project is to carefully plan the students' academic path at both institutions to achieve both degrees' requirements. To facilitate this, the receiving institution identifies a set of courses that may be taken by exchange students during their period of mobility. Defining a set of courses instead of establishing a specific study plan has allowed for more flexibility and has ensured that students can attend courses which are appropriate for their specific background (Malek et al., 2014). However, the sending institution also puts in place a first-year study plan to include that set of courses for the students. The equivalence and the validity of the study plan are checked and verified between universities using the existing administrative procedures, and formally evaluated by specific advisors at each institution. Needless to say, to award students their degree, each student must satisfy the core and elective courses and earn the number of credits necessary set by both the institutions.

4. Tuition, Scholarships and Loan of Honor

According to the project's MoU, students participating in the dual degree program pay tuition in both institutions, depending on their current matriculation. Exchange students bear tuition and fee costs at the receiving institution while physically attending there, and also pay tuition and fees at the sending institution while attending it. To facilitate the implementation of this project and encourage students to pursue such opportunities, NJIT offers a reduced tuition for the Italian exchange students. Participating students are charged tuition and fees at the in-state level. This reduction in cost has been cited as a major driver to the success of the program. This contribution of NJIT has been crucial to achieving project objectives. In addition to NJIT's favorable tuition policy, to help and boost the students' mobility further, the sending institution every year offers several scholarships

(between 2,400 up to 4,000 €) exclusively related to MEM project, to the top performing applicants. The eligibility criteria for this scholarship are:

- Language skills (English level B1); the knowledge of English is preliminary tested through a written exam.
- Academic excellence. The academic carrier of students is evaluated by examining the number of exams passed and the score reported of the undergraduate degree.
- Personal motivation and commitment. The personal motivation of students applying for the project is evaluated through a written letter.

In addition, UNIPR partner Bank, Banca Popolare di Sondrio offers a Loan of Honor up to 15000 € exclusively for students applying to the MEM project to cover students' tuition and housing expenses. The interest rate is much more advantageous compared to rates of competitors. In fact, in Italy, usually, such loans are not offered at all. Banca Popolare di Sondrio extended this unique offer to MEM students as per special agreement between the parties.

5. Challenges and Advantages

In addition to the advantages already described, these types of collaborative programs present challenges, both logistical and academically. The following are some examples:

- 1) As in any international collaboration, the institutions and all involved parties need to communicate effectively to avoid misunderstandings.
- 2) Administrators at all levels have to be made aware of the complexities of such projects, particularly issues that may arise regarding credits equivalencies and each institute transfer credit requirements.
- 3) Flexibility of the institutions involved is a major challenge particularly in recognizing the equivalency of the other university's courses. Often, it is not one-to-one correspondence. Therefore, program advisors should be intimately aware of course contents in order to determine equivalency for each student and identify the remaining requirements to fulfill to earn the degree in the most efficient manner.
- 4) Online registration is also a challenge. Unless already coded, the computer will not recognize that a student has taken a certain prerequisite course elsewhere. So, it will not allow online registration to proceed requiring for a manual intervention. When European students arriving in the US face such delays some courses they need may be closed causing disruptions for students and faculty alike.

None of these challenges were insurmountable and, in fact, most are successfully and quickly overcome. Of course, being as flexible as possible is key to dealing with these and other such challenges. At the same time, it is worth iterating the opportunities that the

MEM program offers to the exchange students. First, students involved benefit significantly by having an international experience during their studies. This means that they could interact with others in distinct cultural, social, linguistic, and educational environments, and experience different teaching and learning methods, thus improving their entrepreneurial skills. Consequently, students are prepared to work as part of an international workforce, coping with the challenges of our modern global economy and industry. In addition, students have the chance to improve their ability to think laterally. Ideally, students can become mature, inquisitive, analytical, and organized. Approaching their vocations from different points of view and learning new ways to solve problems help to develop their passion for engineering. Experiences like these represent a path to discovery and innovative ideas. Placed in different environments, students can meet new people and build their own networks. Communication is another important aspect where the student develops new skills. Communication abilities are increasingly becoming important as engineers frequently interact with specialists in a wide range of fields outside their domains. Another personal asset is for students to develop the ability to work in groups, typical of the American contemporary learning style, where large projects and workgroups are frequently required. Becoming part of a larger group, an individual has a chance to become a team player by working together with others having different characteristics. Finally, other skills are acquired due to the different environments where the student develops knowledge of different countries, the capacity to be self-sufficient, and develop leadership traits. (Mora & Montaner, 2014).

6. Conclusion

No matter where it is taught, force is equal to the mass times acceleration. But among the many value-added are cultural, linguistics, modes operandi, and pedagogic approaches. These attributes significantly add to the educational experiences gained from international collaborative projects to the benefits of both for students and faculty.

At the present time, there are 27 graduate students involved in these double degree programs of Engineering Management (three of them are in the newly developed double degree in Mechanical Engineering.) While no students have graduated yet from these double masters degree programs, our prior collaborative joint projects at the undergraduate level leading to approximately 50 double and triple bachelor's degrees granted to students from the University of Parma, Polytechnic of Valencia, and NJIT (the outcome of an Erasmus and US Department of Education award) demonstrate the values of such international degrees as evident by the successful employment of these graduates. Nevertheless, for this project, initial feedback from participating graduate students is quite positive.

Our experience in this space shows that for these types of programs to be successful, it is of utmost importance that certain components have to be present. Among the most important ones are higher administrative support and some flexibility in the curricula. Top administrative support is necessary to advance programs and enable navigation through institutional complexities. As for the flexibility aspect, no two programs are exactly congruent. Therefore, when transferring courses between programs, graduate advisors should exercise their judgments, owing to the fact that only main concepts of the subjects are learned and not the weekly course syllabi.

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