
AC 2012-5185: ONE CHALLENGE, TWO COUNTRIES: A DUAL AEROSPACE ENGINEERING BACHELOR'S DEGREE PROGRAM BETWEEN NEW MEXICO STATE UNIVERSITY AND THE UNIVERSITY AUTONOMOUS OF CHIHUAHUA

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“One Challenge, two Countries: A Dual Aerospace Engineering Bachelors Degree Program Between New Mexico State University and the Universidad Autónoma de Chihuahua”

ABSTRACT

This paper details the establishing, articulation, and progress of a pioneering strategic partnership directed to offer a dual degree program in the field of Aerospace Engineering. The universities leading this initiative are New Mexico State University (NMSU) and the Universidad Autónoma de Chihuahua (UACH), which are located in the border states of New Mexico, USA, and Chihuahua, Mexico. The trust-based nature of this collaboration is anchored in a long tradition of academic and cultural collaboration between these institutions. The ultimate goal of the program is to set a model for international academic collaboration where student mobility, curriculum exchange, and transferring of credits are no longer a challenge but a reality. In this paper, the authors include a brief description of the partner institutions, including mission, history, size, resources and distinctive characteristics, as well as academic program structure, operating principles and administrative procedures that are guiding this partnership. Additionally, this paper documents the student’s selection process and the enrollment requirements, as well as challenges faced by students, such as language barriers, uneven academic preparedness, cultural shock and adaptation, housing, timing of student visa requesting process, and financial constraints and difficulties. The complete program requires 203 credit hours, 163 from UACH and 33-40 credit hours from NMSU. The first cohort of students started at UACH in the fall of 2007 and is currently enrolled at NMSU with expected graduation date of December 2011. Since Fall 2007, every semester an average of 20 students has been transferred from UACH to NMSU as part of this program. Despite the fact that the Dual Aerospace Engineering program was originally designed to help Mexican students to attain a college degree in the US, it has the potential to benefit students from the US. It is expected that in a short future, US students will be motivated to start their college career at UACH in Mexico with the subsequent advantage of cost education reduction and an international experience that constitutes an asset in their professional development. As it was agreed in the Memorandum of Understanding (MOU), this agreement has been reviewed and modified by mutual consent when required to ensure the optimum level of performance. This paper documents the significance and impact of the present academic collaboration on the engineering communities of both countries.

INTRODUCTION AND BACKGROUND

Internationalization of higher education has impacted the way in which universities perceive, seek, and develop cross-border education. The main reason is that in order to be competitive in a global economy, universities need more than good student mobility strategies; it is required that higher education institutions develop and implement strategic plans that incorporate new networks and collaborative partnerships models (Wildavski, 2011). The University Autonomous of Chihuahua (UACH) and New Mexico State University (NMSU), as part of their institutional strategic plans, have developed an innovative dual degree program that is available to engineering students at UACH and that represents an opportunity for NMSU students to obtain an integral international experience as part of their engineering education.

In the spring of 2007, representatives from the School of Engineering at UACH visited the Department of Mechanical and Aerospace Engineering at NMSU. The proposal was to take advantage of the long history of collaboration between these universities and to explore the possibility to create an innovative cross-border engineering dual degree program challenging the current policies in student mobility, credit transfer, cost of education, cultural adaptation, and language barriers at both institutions. The difficulties posed by this initiative were abundant but the desire to develop this partnership fueled the initiative and immediately an agenda was set to evaluate the feasibility of this project. Once both parties agreed that a project of this magnitude would benefit their respective institutions, they moved forward to define the operational guidelines and administrative requirements to initiate this collaboration.

PARTNER INSTITUTIONS

UACH: Originally named Literary and Scientific Institute of Chihuahua, the University Autonomous of Chihuahua (in Spanish: Universidad Autónoma de Chihuahua, UACH) was founded on March 19th 1835. The main purpose of the Literary and Scientific Institute of Chihuahua was to promote cultural development in the emerging city of Chihuahua. At that time the tendency was to pursue higher education in Mexico City; therefore, it was hard for this recently born institute to recruit students, so in the first year UACH started with just 21 students. In December 8, 1954, the State Legislature, being Governor of Oscar Soto Maynez, issued the decree 171 with which UACH was officially founded. In 1968, UACH autonomy was granted allowing the institution to freely define its own curriculum and manage its own budget without interference from the government. UACH began with schools of Medicine, Engineering, Law, Physical Education, and Pharmacy. UACH is now one of the nation's leading public universities with a current enrollment of 25000 students and its campus has an area of 25 hectares. Under the current Organic Law, the university structure comprises the following academic units: Arts, Agricultural and Forestry Sciences, Agro technological Sciences, Political and Social Science, Chemistry, Accounting and Administration, Law School, International Economics, Physical Education and Sport Science, Nursing and Nutrology, Philosophy and Letters, Engineering, Medicine, Dentistry, Animal Science and Ecology.
http://www.uach.mx/informacion_general/english/2008/06/13/history/) Retrieved on Jan 8, 2012

Mission: *The University Autonomous of Chihuahua (Universidad Autónoma de Chihuahua) is an institution of higher education, public, autonomous, dedicated to educating individuals with universal values capable of appropriate and creative responses to a changing world. Endorses the task to generate, implement, disseminate, transfer, and integrate knowledge, through high quality university programs, whose application will be useful to society and herself. Maintains its original commitment to contribute to social development and to preserve, conserve and enhance the various manifestations of culture in favor of a better quality of life for the people of Chihuahua in particular and Mexicans in general.*
http://www.uach.mx/institucional_y_juridica/2008/03/07/mision/

NMSU: New Mexico State University was founded in 1888 as Las Cruces College under the leaderships of Hiram Hadley, a respected educator from Indiana. The Territorial Legislature of 1889 established the land-grant Agricultural College and Experiment Station, which officially opened on January 21, 1890. During its first full academic year, the college became known as the New Mexico College of Agriculture and Mechanic Arts, the first degree granting institution in the Territory. Under the provisions of the Morrill Act of 1862 and subsequent federal legislation,

the special mission of land-grant institutions has been to provide a liberal and practical education for students and to sustain programs of research, extension, education, and public service (NMSU, Policy Manual, 2007). That first semester there were 35 students in the college level and preparatory classes and six faculty members. Classes met in the old two-room building of Las Cruces College until suitable buildings could be put on the 220-acre campus three miles south of Las Cruces. By 1960, the school had grown greatly, and its name was changed by state constitutional amendment to New Mexico State University. Since that time, while sustaining excellence in those programs traditionally associated with land-grant institutions, New Mexico State has become a comprehensive doctoral level university offering a wide variety of programs through the Graduate School and the colleges: Agriculture and Home Economics, Arts and Sciences, Business Administration and Economics, Education, Engineering, and Health and Social Services. Today New Mexico State University sits on a 900-acre campus and enrolls 18000 students. <http://www.nmsu.edu/General/history.html>. Retrieved on Jan 8, 2012.

Mission: *New Mexico State University is the state's land-grant university, serving the educational needs of New Mexico's diverse population through comprehensive programs of education, research, extension education, and public service.* New Mexico State University, *Policy Manual*, retrieved on March 2012, <http://www.nmsu.edu/manual/documents/intro.pdf>

Since 1989, UACH has worked cooperatively with NMSU to create and advance programs of higher education, to promote culture and to perform activities of research and outreach. Examples of collaboration include joint research projects, externally funded service programs, cultural exchanges, and dual and joint degree programs.

EDUCATION MODEL DESIGNED FOR THE AGREEMENT

The educational model selected was a Dual Degree program that is an agreement allowing the participant students to receive two separate engineering degrees. The degree comprises 9 semesters of academic work to meet the credit hour requirements at both institutions. In addition, to the course work, UACH requires their graduates to complete a period of social service. This component should be completed prior to the transferring of students to NMSU. To make this program more accessible in terms of cost of education, it was agreed that UACH would offer the first six semesters of the degree program while NMSU will offer the 7th through the 9th semesters. The complete program will require a maximum of 203 credit hours, 163 from UACH, and 33-40 from NMSU (the number of final credit hours may vary based on the students English language abilities). Both universities agreed to transfer the corresponding credit hours so that the students would be able to complete the academic programs at both institutions.

The selected method of instruction was lecture based traditional teaching, meaning face-to-face instruction. The students wishing to enter this program will register as full time students at UACH from semester 1 through 6 and register at NMSU as full time students for semesters 7 to 9, and must satisfy the entrance requirements at both universities.

The dual degree format was selected because of the considerably reduced legal issues related to the program implementation. According to the Institute of International Education (IIE) in their report called "Joint and Double Degree Programs in the Transatlantic Context: A Survey Report" published in 2009 (Kuder and Obst, 2009), there are significantly more double degrees than joint degrees. The report summarizes the responses from 180 higher education institutions in the

United States and the European Union. Their findings indicate that in the US there are 50 joint-degree and 613 dual degrees in place, while 172 joint and dual degrees are in the planning stage.

ADMINISTRATIVE PROCEDURES AND PROGRAM DEVELOPMENT

This program initiated operations in the fall of 2007 at UACH. The program had a tremendous impact in the state of Chihuahua with more than 200 students applying to enter this program in the first semester and with an increasingly higher demand in the subsequent semesters. Due to Mexican university policies, around 50 students were admitted considering that in three years nearly 35% of the students will be changing majors or dropping from the university. In the fall of 2010, the first cohort of 30 students originally admitted to the joint-degree program at UACH in 2007, was successfully admitted to NMSU to continue with the 6th, 7th, and 9th semesters towards their dual degree completion. To enroll at UACH the students were required to pass a national standardized exam of the Centro Nacional de Evaluación (CENEVAL) that is considered an admission test for post-secondary institutions in México. The students apply for the required program and they are notified in a timely manner if they were admitted.

PROGRAM DEVELOPMENT AND IMPLEMENTATION

It is important to note that this program was created as part of the Strategic Plans of both institutions. These plans emphasize the importance of increasing the number of international collaboration in the STEM fields (Science, Technology, Mathematics, and Engineering) and not because of individual or isolated professors' activities or initiatives. Therefore, it is important to mention that the commitment of authorities at both institutions was instrumental in the design, development, and implementation of the program. Logistically, having high-level administrators involved in the process since the planning stages truly accelerated the administrative procedures required for the progression and implementation of the agreement. Interestingly, in less than six months from the initial meeting, the final agreement was signed, allowing the starting of the program in the fall semester of 2007. A valuable lesson learned from this collaboration, is that success in this type of partnership is directly related to the involvement of Deans and Department Heads.

Driven by the mutual interest to fulfill the agreement, representatives of both institutions, along with the main author of this paper in her role as liaison, strategized a course of action to develop and implement the program in a short time. The period before the signing ceremony was characterized by constant communication and a loaded working agenda directed to assess the feasibility of the project and to establish tentative guidelines for program operation. As an example at an initial stage, authorities and representatives from the NMSU Mechanical & Aerospace Engineering (MAE) Department, the main author of this paper in her role as liaison and interpreter, along with representatives of the office of NMSU International Programs traveled to Chihuahua, Mexico to attend a meeting hosted by UACH School of Engineering administrators. The objective was to assess the proposed program of study and the articulation of degree requirements and curricula, the distribution of credits, language requirements, cost, in-state tuition waivers, and other issues related to mismatched academic calendars.

The signing ceremony was held in the summer of 2007 at the city of Chihuahua in the facilities of the Universidad Autónoma de Chihuahua. This ceremony served as a showcase to portray the collaboration among the academic community in Mexico. Consequently, several Mexican institutions of higher education were motivated to look for similar opportunities to establish

international academic partnerships and collaborations. Although, each partner institution had their own specific motivations to establish this partnership, common motivations included: advancing the internationalization of higher education, attaining international recognition and visibility, increasing student's opportunities and mobility, and developing and strengthening academic networks of cooperation.

PROGRAM CHALLENGES

During the initial semester, the educational experience for students, faculty, and administrators at both institutions was valuable and helped to adjust and modify the program. The goal was to help the students to succeed in their career and to support the continuation of this program. For example, as expected, the language limitations and different cultural environment put an extra burden on the students. To address this issue quickly, conversations between NMSU and UACH started about the possibility of implementing a more rigorous student selection process considering a higher level of language proficiency and increasing the language preparedness of the students waiting to transfer to NMSU in the following semesters. Therefore, it was agreed to structure a more formal training in the English language at UACH before the student's transfer to NMSU; additionally, a short English workshop was offered to the students once at NMSU, prior to the beginning of their first semester. Moreover, as part of the program curriculum at NMSU, the students were required to take additional English classes according to their individual needs.

The differences in the academic culture contributed to problems faced by the students and limited their performance. In the planning stages, it was hard to predict the difficulties that the cultural shock and adaptation would pose for the students. For example, in Mexico the academic programs include more teaching hours, with less work outside class, while the American style favors less teaching interaction with a significant amount of time dedicated to homework, assignments and projects outside the classroom. This particular situation caused several problems; students were overwhelmed trying to level their language proficiency with the responsibility to solve and submit their daily assignments.

Another constraint for the students and their families was the cost of living in the US. This situation affected not only the students currently attending NMSU but also the plans of students ready to enroll to NMSU the following semester. This situation also created an administrative problem for UACH. They had to have a lateral exit or an alternative venue for completing a bachelor's degree for students currently enrolled in the program that due to economic constraints would not be able to transfer to NMSU.

On the other hand, NMSU also faced important challenges. Because of the world wide economic crisis, universities in the US have had to reduce their enrollment due to limited number of faculty available to teach specific courses. In this respect, the Mechanical & Aerospace Engineering Department (MAE) limited the domestic and foreign enrollment to ensure quality for all the students enrolled in the Aerospace program. In consequence, it was necessary to request a reduction on the number of students admitted to this program. Currently, proactive discussions are being held in order to keep the enrollment to 20 per semester.

Despite the difficulties on December of 2011, the first cohort of students of the NMSU-UACH Dual Degree Program in Aerospace Engineering participated in the commencement exercises at NMSU. In the first cohort, twelve students out of the original thirty completed their degree at NMSU; UACH will grant the degree as soon as NMSU completes the administrative transferring

of credits to UACH and the students submit their degree diploma along with its official transcript. Thanks to the NMSU-UACH collaboration, this group of students reached an enormous accomplishment by graduating with two degrees from two different countries. This fact also represented a big achievement in cross-border education.

The overall assessment of the program indicates that as the program progresses unforeseen challenges will appear. With the economic difficulties increasing around the world, the long-term sustainability of the program is a big concern for both institutions. On the Mexican side, for example, it is expected that government agencies and other private institutions will be willing to provide funding to help the students alleviate the burden of covering the educational cost in the US. On the other hand, NMSU is concerned about how to compensate the tuition waivers and low students fees they are providing for Mexican students without drawing more funding from the university budget and other external resources.

Another important aspect to ensure the sustainability of the program is to establish applicable mechanisms to assess the progression and effectiveness of the program. As of now, this aspect has been neglected but it will be necessary to develop strategies directed at ensuring that this important aspect is covered. Therefore, quality assurance and accreditation should be included in the short and long term agendas of this collaboration. This issue is more significant for NMSU because it is an ABET accredited institution so it must comply with its accreditation requirements. To address this and other unseen challenges, it is recommended to identify the most successful joint-degree programs currently in place in other institutions and countries in order to model, adapt, and implement best practices in cross border education.

CONCLUSIONS

One of the major challenges this program has faced so far has been the communication at an institutional level; however, it is evident now, that the success of this agreement will have a huge impact in the way in which international partnerships are going to be implemented in the future. An extra effort should be exercised in order to strengthen this collaboration and to protect the continuation of this program in the short and long terms. Although this program is currently benefiting the Mexican students, this program has the potential to offer an international educational experience for North American students who may take advantage of the low cost of education in Mexico.

This program is unique in its class in Mexico and historically has set a record in that country as the first Twinning degree with a university in the US. For the US, this is an important accomplishment as well, because this collaboration is sending a clear message to the global academic community that such collaborations could be challenging but undoubtedly highly rewarding. Several unforeseen challenges have emerged and sound solutions have been implemented and certainly many more are to come; however, the proactive collaboration between NMSU and UACH is an indication that the internationalization of higher education requires hard work, creativity, and a big dose of institutional commitment.

RECOMMENDATIONS

In closing, we offer the following recommendations to US universities contemplating joint undergraduate degree programs of the type discussed here (some semesters at a foreign institution followed by some semesters at the US institution).

1. The entrance requirement for English proficiency should be high and stringently enforced. An International English Language Testing System (IELTS) level 6 is recommended.
2. The quality of the English instruction in the foreign university should be monitored during the period prior to enrollment in the US university.
3. The quality of the engineering science courses at the foreign university should also be monitored; engineering courses at the foreign university may use the same textbook and similar syllabus as the US university, but the depth of the material studied by the students may vary.
4. The academic requirements for any scholarships and/or tuition waivers should be made clear at the outset; some students may not pay adequate attention to these requirements.
5. The “learning culture” of the foreign institution should be studied onsite ahead of time. The norms for in class work versus homework, late homework, group work, asking questions during exams, office hours versus open door availability, and generally the workload expectations of the students, etc., are valuable to know.
6. A dedicated non-faculty advisor should be assigned to handle academic and non-academic matters arising among the foreign students; they will likely need a specific person to solve problems or to answer questions.
7. It is advisable, if practical, to hold early and regular information sessions with the foreign students and their parents prior to the students’ moving to the US university.
8. Some math remediation (e.g., in differential equations) may be advisable if the foreign students completed their math several semesters prior to enrolling in the US university.

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