Next Generation of Engineers: An International Experience

Dr. Albertus Retnanto, Texas A&M University at Qatar

Dr. Albertus Retnanto is a Program Chair and Professor of the Practice of Petroleum Engineering at Texas A&M University at Qatar and has been in the Petroleum Engineering program since 2009. He received his Ph.D. degree in Petroleum Engineering from Texas A&M University. He held a Principal position with Schlumberger and has more than 18 years of experience worldwide in technical and management positions in well testing, field development, and production enhancement. He served as SPE Drilling & Completion journal review chairman, SPE Cedric K. Ferguson Medal Award committee member, SPE Drilling, and Completion Advisory committee, and SPE advanced technology workshops. He received the A Peer Apart SPE Award, which is dedicated to the technical excellence of authors to the industry. He received the Associate of Former Student of Texas A&M University College-level Distinguished Achievement Award in Teaching and Distinguished Achievement for Petroleum Engineering Faculty, Society of Petroleum Engineers-Middle East & North Africa Region. Dr. Retnanto is an active Program Evaluator (PEV) with the Engineering Accreditation Commission (EAC) of ABET.

Dr. Hamid R. Parsaei, Texas A&M University

Hamid R. Parsaei is a Professor of Industrial and Systems Engineering and Director of the College of Engineering Accreditation and Assessment at Texas A&M University-College Station. He is a registered professional engineer (PE) in Texas.

Boback Parsaei, Texas A&M University

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Abstract

What happens when a Middle Eastern country invites a leading U.S. university to deliver its world-class engineering degrees 8,000 miles from its home campus? In 2002, Texas A&M University established an international campus in Qatar at the host nation's request. The mandate was ambitious: create four ABET-accredited engineering programs to cultivate highly skilled local graduates and support the country's long-term development goals.

While all programs were shaped by strong industry advisory boards and rigorous admission standards, including interviews and high rates of multilingual proficiency, Petroleum Engineering (PETE) developed a particularly distinctive feature: a required, one-credit seminar course. In this course, students worked individually or in teams to solve real-world industry problems and presented their solutions directly to program advisory board members. The seminar became a proving ground where students demonstrated technical competence, teamwork, and professional communication skills to potential employers. As a result, the course not only strengthened student preparedness for the workforce but also provided employers with direct insight into graduates' readiness to contribute effectively in professional settings.

This presentation reports on nine years of data drawn from student projects and advisory board interviews. Findings show how PETE's seminar course not only enhanced employability outcomes but also exemplified the workplace-informed approach that guided the entire international campus. Lessons from this study offer broad insights into how global partnerships can advance engineering education and prepare graduates for professional success.

Keywords
Cultural Ethnicity; Effective communication; Engineering program; Ethical issues; Teamwork

Introduction

Many countries in the Middle East, particularly in the Persian Gulf region, including Qatar, Kuwait, Bahrain, the United Arab Emirates, and Saudi Arabia, have developed a Vision 2030 that outlines their long-term plan to build human capacity and further promote technical education, ensuring the next generation relies less on the country's petro-dollars and moves from a traditionally fossil-based economy to a knowledge-based system. Technical education is one of the primary pillars of their Vision 2030, common among all the countries in the region [1].

Since the beginning of 1990, government educational offices have made significant investments in building Western-style academic institutions to attract well-regarded international institutions to establish branch campuses or to offer twinning degree programs. The primary demand for degree programs since their inception has been in engineering, business, and medicine and its allied fields [2-5].

One of the countries in the region with a well-grounded plan to achieve its goals is the small Gulf State of Qatar, which has actively embraced these technologies, invested heavily in education and training facilities, and encouraged its high school graduates to pursue high-tech programs across most disciplines, including engineering. Qatar is located on a peninsula, with the Persian Gulf to the east, north, and west. In the south, Qatar is connected to the Kingdom of Saudi Arabia by land. Like several of its neighbors, Qatar has made a significant investment in education by establishing international high schools that allow students to develop English and other language communication skills. This policy has proven highly effective, making the transition from high school to international campuses in the country seamless [6 and 7].

While Arabic is a spoken language in the region, a large number of expatriates whose occupations include medical engineering, business, and construction, as well as a large segment of the Qatari population, were encouraged to learn English. About 20 percent of Qatar's close to two million population are citizens, and the rest represent more than 80 countries [5 and 6].

In the early 1990s, Qatar Education City was established as one of the entities managed by Qatar Foundation, a nonprofit organization with a primary focus on education. Qatar Foundation successfully attracted six highly rated American universities, including Texas A&M University, Cornell University, Carnegie Mellon University, Georgetown University, Northwestern University, and Virginia Commonwealth University, to create branch campuses in Education City. In the early 2000s, each institution established programs requested by Qatar Foundation in a specific area, with no duplication [7].

Background

Texas A&M University-Qatar Campus began operations in the fall of 2002, offering four engineering degrees, including Chemical, Electrical, Mechanical, and Petroleum. All four degrees have been reviewed and accredited since 2008. Texas A&M University's admission standards have been among the highest in the region. In addition to the credentials presented, including grade point average (GPA), ACT or SAT exam scores, and letters of recommendation, all initially admitted candidates are further screened through an extensive interview conducted by a team of Admissions Office staff and volunteer faculty members. In addition to proficiency in English and Arabic, most students speak a third language, depending on their countries of origin. About 50% of the students admitted to the school's programs are Qataris, and the rest are expatriates. In some disciplines, including Electrical Engineering and Chemical Engineering, over 50% of students pursuing degrees are female. Texas A&M University has also established a graduate program leading to the M.S. and M. Engr. degrees. Since the school opened its doors in 2002, it has produced over 1,800 graduates who are employed in Qatar and surrounding countries, and some have pursued graduate degrees and earned Ph.D.s in the United States and Europe.

While all programs benefit from their industry advisory boards, which meet twice a year and participate in final design project (capstone design) presentations, the Petroleum Engineering (PETE) program developed a distinctive feature: a required one-credit seminar course. In this course, students work in small teams to solve real-world industry problems and present their

solutions directly to the program's advisory board. The seminar became a proving ground where students demonstrated technical competence, teamwork, and professional communication skills to potential employers [8 and 9].

In order to have a successful educational experience, it is essential for students to actively participate in the learning process. This helps to create an interactive atmosphere in which students take responsibility for their own education rather than simply standing and listening to lectures. The active participation of students helps to cultivate an educational environment in which students acquire knowledge by the application of that knowledge. In their study, Hernández-de-Menéndez and colleagues [10] demonstrated that active student participation not only improves conceptual comprehension but also makes it easier for students to achieve their learning outcomes. According to the findings of other studies [10 and 11], active student participation is associated with improvement in academic performance and success, as well as an increased desire to learn.

Experiential learning is an additional method of instruction that considerably improves the learning experience of students and encourages active participation from students involved in the learning process. According to [12], this method gives pupils the opportunity to put their academic knowledge to use in real-world situations. In addition to this, it assists students in connecting content learned in the classroom to real-world applications. Internships are educational tools that give students with practical experience while simultaneously improving their employment prospects after graduation [13]. Internships serve as a tool for students to gain practical experience. One of the additional advantages of using experiential teaching methods is that they encourage the development of a variety of skills, including adaptation, communication, and teamwork, all of which are necessary for success in a professional work environment [14 and 15]. Furthermore, they contribute to the strengthening of talents in areas such as critical thinking, creative thinking, and problem-solving [16].

Observations Made and Recommendations Received from the Course Audience

Senior students are expected to participate in the annual petroleum engineering student paper contest, which is judged by industry professionals. Presentations follow the Society of Petroleum Engineers (SPE) style. The student paper competition is a long-standing tradition in the Petroleum Engineering department at College Station. Students must give a presentation on a topic of their choosing, typically one that involves an independent or undergraduate research project. The presentation must last fifteen minutes. Despite this, students may present on any subject related to petroleum engineering. Students are responsible for choosing the topic, conducting independent research, and preparing the presentation. In most cases, two or more presentation sessions are held simultaneously, and each session is evaluated by panels of three to five individuals involved in the sector. On average, fifteen to twenty professionals from the technical industry participate throughout the day. During the first part of the competition, there is a faculty session, a leaders and technical judges orientation meeting. The judges' duties and the evaluation rubrics used are discussed. After that, the judges return to their sessions, listen to one or two presentations, and then set their ratings based on the rubrics they have been given. During

calibration, faculty session leaders provide assistance but do not evaluate or criticize the presentations. In accordance with the criteria, the judges assign a score between 1 and 4 to the level of student achievement, with 4 indicating proficient or skilled ability and 1 indicating a lack of capability. As an example of a rubric that can be used to demonstrate the capability of effectively communicating verbally (clarity of technical material), Table 1 provides an example of that rubric for one criterion. Figure 1 demonstrates the assessment outcomes from 2017 to 2025 on the effectiveness of verbal communication. It is clear from the results that there has been an upward trend in the students' capacity for oral communication.

Table 1. Rubric effectively communicating verbally

1. Most of the time, ideas weren't presented in a logical or organized way, and it wasn't clear what the authors thought about the topic's importance, the problem, and its answer (if any), or the conclusions.	2. The ideas were mostly put forward in a logical way, but the presentation was a bit disorganized, and there were at least a few statements that weren't clear about the topic, problem, or solution (if relevant), or the conclusions.	3. Ideas were presented rationally and in a structured way, with mostly clear explanations of the topic's importance, the problem, and its solution (if necessary), and the conclusions. However, a few small details were not entirely clear.	4. Thoughts were presented in a clear and organized way, with clear explanations of the importance of the topic, problem, and solution (if relevant), as well as conclusions. Only a few minor points were not made clear.

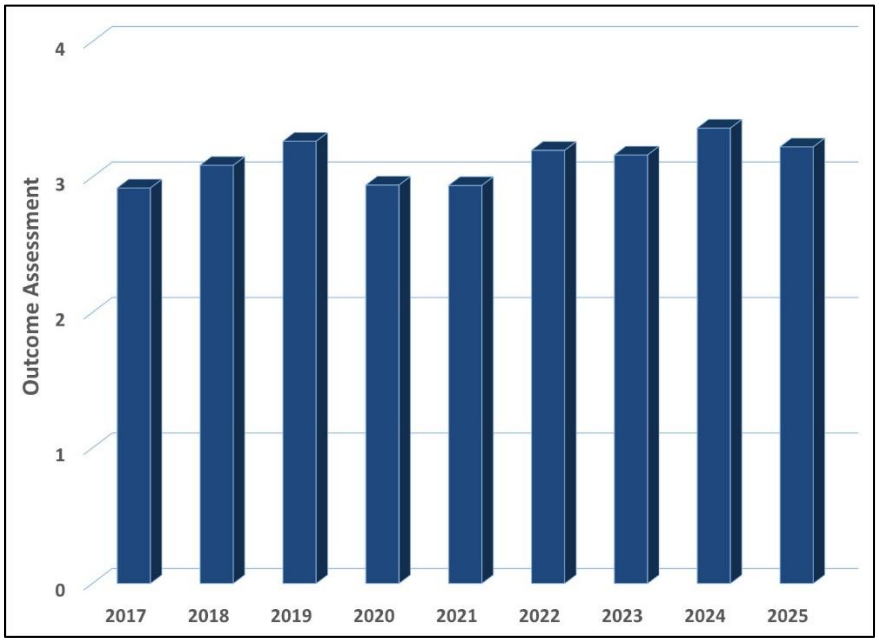

Figure 1. Assessment on the effectiveness of communication verbally

In addition, judges can document their thoughts on specific presentations, and the program then reads and saves them. Judges determine the winners of each session and rank them from first to second place.

Winners of the senior student paper contest submit their abstracts to the Society of Petroleum Engineers regional student paper contest. This major event is held annually in one of the capitals of the Middle East and North Africa. The winners of that regional competition then participate in the SPE Worldwide Student Paper Competition, held during the SPE Annual Technical Conference and Exhibition (ATCE), the most important event in upstream oil and gas, which often attracts more than 8,000 attendees. TAMUQ Petroleum Engineering has received substantial financial support from industry to cover event costs and prize money, underscoring the industry's recognition of the activity's significance.

Student Field Trips and Simulators

Engineering students must devise solutions that meet specific requirements while accounting for multiple considerations. Accreditation bodies mandate this as a component of preparing students for their professional endeavors. Consequently, practical experience is a fundamental component of engineering education. Engineering programs ought to provide field excursions pertinent to their disciplines. Field trips provide an experiential connection between students and the real world. A site visit to a drilling rig in petroleum engineering provides students with knowledge of drilling rig components, drilling fluids, drilling operations, and safety protocols during the drilling process. Furthermore, the tour enables students to engage with the authentic work environment of the oil and gas sector. Figure 2 illustrates a cohort of PETE students observing drilling operations at an onshore rig. Field visits enable engineering students to connect their academic knowledge with practical industry applications. Furthermore, the use of drilling training simulators or software simulators enhances the learning process. Figure 3 illustrates a drilling simulator located in the PETE laboratory at TAMUQ, used to instruct students on the procedures and controls involved in well drilling. The field visits and the drilling simulator provide outstanding practical experience that increases students' motivation and interest, thereby enhancing their learning.

Figure 2. Student field trip to the drilling rig

Figure 3. A student being trained in how to use drilling simulator

Virtual Reality App for Head-mounted Displays

Students will have the opportunity to gain first-person experience of strolling and exploring an offshore drilling platform through a program based on a head-mounted display. In contrast to the CAVE application, which allows only a single viewer at a time, the HMD application enables multiple students to experience it simultaneously. The virtual reality experience begins at the helipad, typically the location where one would be transported from the terrestrial location to the rig by helicopter. The viewer can then use the handheld motion controller to either walk or teleport to a chosen position to reach the desired location. To provide the viewer with information, the major components of the rig have been labeled. Various screenshots of the application are shown in Figure 4. Additionally, a brief animation of the drilling process has been included in the application.

Figure 4. Images of the HMD VR application interface

Workplace Learning through Internships

In order for students to graduate from the Petroleum Engineering (PETE) program, they are expected to complete an internship at a company involved in the oil and gas industry. It is widely acknowledged that this internship provides a substantial amount of practical experience. This internship must be completed over the summer between the third and fourth years of study to fulfill the requirements of the program. A minimum of six weeks of full-time employment, equivalent to thirty working days, must also be included in the program. This employment must

be under the supervision of industry professionals. Students are afforded the opportunity to acquire short-term work experience, which not only helps them become more acquainted with the professional environment but also makes it easier for them to integrate their academic knowledge with practical applications, ultimately increasing their employability.

Following the completion of the interns' internships, the supervisors will administer a brief survey to evaluate the interns' overall performance. One component of the survey assesses the degree to which the students are prepared for the professional occupations they will pursue in the future. In comparison with the earlier polls of educational resources, this survey uses a four-point Likert scale, ranging from "Poor" to "Excellent," with the following coding: Poor is coded as one, good as two, very good as three, and excellent as four. The supervisors of the internships evaluated the students based on six factors described in Table 2. These characteristics are listed in the table.

54 internship supervisors participated in this survey, and 45 students were evaluated by them. Based on the aggregate of excellent and very good assessments for each characteristic, the data in Table 2 indicate that more than 80% of the 56 internship supervisors at TAMUQ believe that the PETE students at TAMUQ possess noteworthy attributes that sufficiently prepare them for industry transition upon graduation. Furthermore, ninety-five percent of supervisors noted that students successfully accomplished the goals of their internship assignments. This success can be linked to the students' strong analytical talents, technical proficiency, and discipline. A total of ninety-two percent of supervisors believe that students have exceptional communication skills. Consequently, it is possible to state that supervisors in the internship industry have a high level of satisfaction with the quality and talents of TAMUQ PETE students participating in internships.

Table 2. Rate of performance of student interns

Evaluation Qualities		**Excellent**	**Very Good**	**Average**	**Mode**
1	Proactivity	36 (64%)	14 (25%)	3.52	4
2	Ability to think critically	27 (48%)	26 (46%)	3.41	4
3	Getting Things Done	34 (61%)	19 (34%)	3.54	4
4	Drivenness	45 (80%)	8 (14%)	3.73	4
5	Technical Skills	22 (39%)	25 (45%)	3.21	4
6	Self-Discipline	44 (79%)	9 (16%)	3.70	4
7	Communication Proficiencies	40 (71%)	12 (21%)	3.61	4

Student internships directly enhance various engineering Program Outcomes by providing a structured, supervised environment for students to apply theoretical knowledge in practical oil and gas contexts, thereby reinforcing problem-solving, technical skills, teamwork, communication, and professional conduct. The compulsory six-week internship in the PETE program, conducted between the third and fourth years, is assessed through employer surveys that evaluate students on proactivity, critical thinking, task completion, motivation, technical competencies, self-discipline, and communication skills. Over 80% of supervisors rate "very

good" or "excellent," and 95% confirm that students met their internship objectives. These attributes closely correspond with prevalent ABET-style outcomes (such as the application of engineering knowledge, teamwork, effective communication, and preparation for professional practice), the internship serves as both a significant learning experience and an indirect assessment mechanism for Program Outcomes by furnishing external evidence of students' preparedness for industry and employability upon graduation.

International Professional Exposure and Global Readiness

Students acquire international professional experience through various avenues, including industry-sponsored design projects, participation in international conferences and student paper competitions, involvement in regional technical contests, and collaborative research endeavors with partners from diverse countries. Numerous activities are executed in collaboration with international oil and gas corporations or professional organizations, placing students in settings where they engage with engineers, managers, and researchers from diverse national and cultural backgrounds. This ongoing engagement with many professional communities enables students to comprehend global industry expectations and norms early in their studies.

A fundamental benefit of these experiences is the ability to learn about the varied technical standards and regulatory frameworks used in the region and around the world. Students can compare the methods and technologies used in Qatar with those in adjacent nations and around the world, enabling them to identify both common industry benchmarks and local variations. Through project work, technical presentations, and facility visits, they learn how international businesses implement best practices, manage risk, and address sustainability issues, broadening their understanding of the larger professional context in which petroleum engineers work.

Presenting technical work to foreign audiences and receiving comments from experts with diverse backgrounds and cultures all help foster a global professional mentality. These international professional exposures supplement the formal curriculum and local internship experiences, making students more prepared to join global energy operations or pursue higher studies and professions in a variety of international settings.

Conclusion

During the four-year undergraduate program, it is possible to develop professional skills. A deliberate emphasis should be placed on these needs within the engineering program. To be successful in their work, it is essential for students to acquire the necessary professional abilities. The performance of students can be improved through engineering curricula and extracurricular activities, which can ultimately lead to greater career success for engineers. To determine how the quality of professional skills is maintained, the assessment is conducted.

It has been demonstrated through the findings that the program not only improved employability outcomes but also served as a model for the workplace-informed strategy that was utilized throughout the entire international campus. The findings of this study provide a wealth of

information regarding the ways in which global partnerships might improve engineering education and better prepare graduates for success in their professional lives.

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