Improving the Classroom Environment: With a Focus on the Arab Gulf States

Waddah Akili
Professor of Civil Engineering (Retired)
Principal, Geotechnical Engineering, Ames, Iowa

Abstract:
This paper focuses on “viable teaching-learning” protocols for potential adoption by educators in the Arab Gulf States, seeking to improve their classroom effectiveness. It was inspired by remarks and suggestions made by a number of engineering graduates, who have experienced “negative” aspects of the “classroom environment” as students in the Gulf Region. The paper dwells on those strategies, believed to be appropriate for the development of a “positive teaching-learning” environment; and in particular, those activities that are more relevant to the Arab Gulf States. Strategies pertaining to: (i) planning courses, (ii) conducting courses, and (iii) developing positive learning environment, in and outside the classroom, are discussed and supplemented with general advice and suggestions based on the experience of the author. It is also argued that “reformation” and “active learning” ought to start within the public school systems of the Region, where existing “traditional” teaching methods tend to suppress independent thinking, and have failed in equipping students with the desired traits and analytical skills deemed necessary for students who wish to get into engineering. The paper also examines the potential role that industry in the Arab Gulf States should aspire for setting up and sustaining a principled, dynamic, and forward-looking educational framework that fosters constant renewal and is in tune with prevailing social and cultural realities. Alongside, a more liberal classroom setting that features active learning, care, and strives to accommodate students varied learning styles.

Introduction:

An increasingly global and technically interconnected workplace is pressuring engineering colleges in the Arab Gulf States (Saudi Arabia, Bahrain, Kuwait, United Arab Emirates, Qatar, and the Sultanate of Oman) to take bold steps towards “reforming” engineering education in the Region, so that it keeps pace with new developments and meets industries’ demands for qualified graduates for potential insertion into a highly competitive international market.

Many engineering educators and concerned individuals (including the author) have recognized this challenge; and recommendations to reform the existing educational systems have become wide-spread across many campuses in the Region.(1,2,3) Unfortunately, inhibiting factors such as:
a) lack of collaboration amongst institutions in the Region, b) absence of a clear mandate for reform; and, c) resistance “to change”, as expressed by many decision makers who have always argued against any potential change; have (for the time-being) dampened efforts in this regard. Despite setbacks and curtailments, viable ideas, suggestions along with preliminary strategies for “a change” have permeated through the academic circles, pointing towards specific educational issues where “a change” appears necessary.

Amongst the many issues being debated on college campuses today are: (i) the need to reform present programs and curricula, (ii) the need to introduce organizational changes, (iii) the need to collaborate with industry in the Region, (iv) the desire to foster appropriate engineering culture in the classroom and at the workplace; and, (v) the need to introduce effective assessment methods for the purpose of improving students’ learning and help optimize the teaching-learning processes. In broad terms, two interrelated thrusts for “a change” have emerged lately, and appear to be addressed simultaneously today. First, those that are systems and structure-related such as: programs, curricula, facilities, faculty and staff capabilities, management, etc. And, second, the more intricate, less tangible, and more complex educational issues that have been receiving considerable attention in the U.S.\textsuperscript{(4,5,6)} and elsewhere\textsuperscript{(7)}; namely: the classroom environment, appropriate teaching methods, and learning styles. Included here are “catchy” terms such as: student-centered learning, interactive modes of learning, scientific knowledge more explicitly linked to societal issues, motivation for learning, alternative teaching techniques, etc. In particular, those methods that promote active learning and are cognitive of students’ varied interests and learning styles, have assumed center stage.

This paper outlines some strategies for educators in the Arab Gulf Region seeking to improve their classroom effectiveness. Specifically, the paper discusses some practical suggestions that may help change the learning environment from teacher-centered to student-centered. The paper echoes some of the findings of Sheila Tobias\textsuperscript{(4)} who asserts that traditional classroom environment suffers from: lack of community between instructor and students, lack of identifiable goals in a course (i.e., the “big picture”), and absence of cooperative modes of learning. By and large, classroom setting today, in many colleges of the Gulf Region, is rather rigid and non-conducive to proper interaction (both between the instructor and the students and among the students themselves). Indicators show that a sense of community among students (when participating in an active learning environment) tends to exhibit higher levels of achievement, develops more positive interpersonal relationships, achieves greater levels of academic self-esteem, and tends to increase students’ retention of knowledge in science and engineering subjects.\textsuperscript{(4,5)}

In this paper, various strategies for success in the classroom are outlined and discussed. In particular, activities pertaining to: 1) planning courses, 2) conducting courses, and 3) developing positive learning environment (in and outside the classroom), are explored. In short, what colleges of engineering in the Arab Gulf States should aspire for is: a dynamic, forward-looking educational framework that fosters constant renewal and is in-tune with social and cultural realities. Then, and only then, a more liberal classroom setting, which features: active learning, care, and accommodates students’ varied learning styles, may emerge.
In this endeavor, the author draws on his own experience as a faculty member in the Arab Gulf States (recently in Qatar and earlier in Saudi Arabia); in addition to views and suggestions of: colleagues, students, graduates, and business leaders.

A Glimpse at Engineering Education in the Arab Gulf Region:

Engineering education in the Arab Middle East is relatively new, as organized educational endeavors go. It had its early start shortly after World War I. Colleges of engineering (or schools of engineering as they were labeled) were founded then, in Cairo and Alexandria, Egypt, and also in Beirut, Lebanon. By the end of World War II, colleges of engineering sprung out in Iraq and Syria. And two decades later, Jordan had its first college of engineering in its capital, Amman. The colleges in Lebanon and Syria paralleled, by and large, the French schools of engineering; except for the American University of Beirut (AUB), typically a North American school, looked after by a consortium representing colleges on the East Coast of the USA. Colleges in Egypt and Iraq were influenced, at the time of their establishment, by the British system of education. (1, 2)

Engineering education in the Arab Gulf States started, in earnest, during the early to mid sixties. Initially, colleges of engineering were founded in Riyadh, Jeddah, and later on, in Dhahran, Saudi Arabia. In the other smaller states of the Region, other engineering colleges were founded soon after these states have gained their independence. Although many of the recently established engineering schools in the Region have been impacted (positively and/or negatively) by events in neighboring Middle East countries; the fact that the Region has always had strong ties to some western countries, and in particular the USA, has helped enormously in setting up, manning, and providing needed guidance to these fledgling institutions during their early years. The dramatic increase in oil revenues during the 70s, and 80s, coupled with lack of skilled professionals in areas deemed necessary for growth and development of oil-related industries of the Region, has been pivotal in the start up of higher education in general and engineering in particular. There are today eight public colleges of engineering in the Region (Table 1) in addition to several, recently founded, private and semi private colleges and/or universities that offer engineering degrees. These eight public colleges have, since their inception, been guided by advisory boards made up largely from faculty members drawn from US colleges. Previously, the Grinters Report (8) and the Goals Report (9) were used to guide the educational process. Recently, ABET Engineering Criteria 2000(10) has been the subject of seminars and workshops, intended to shed light and assist engineering colleges in the Region in making use of the EC2000 whenever possible. Indeed, the EC2000 has generated a lot of interest and challenges for the Region. Whether or not it will be implemented, would depend on: institutional vision, available resources, students’ preparedness, and prevailing traditions and norms.

The public colleges of engineering -eight in all- are part of the public university systems in the Region, and thus are government run and almost totally government financed. The organizational structure is nearly the same in all. Students are mostly nationals of their respective countries and graduates of similar public education systems. Admission policies, for all eight colleges, are based on grades obtained in an official examination sanctioned by the Ministry of Education, upon completion of the 12th grade. Additionally, an entrance exam and evidence of proficiency in English, a requirement imposed by many of these colleges, may exempt the applicant from a pre-engineering “prep year” administered as a separate unit from the college. Statistics have
shown that over 80% of first year engineering students do attend the “prep year,” during which students embark primarily on learning English skills. The author has proposed to reform the “prep year” by making it a two-year program, and widening the scope of the subject matter to include (in addition to building up English language skills to a pre-set level), the following tasks: (i) math and science courses, in preparation for engineering “gateway” courses; (ii) a practical hands-on “pre-college” training period; and (iii) fostering a “proper learning environment”, in order to help students acquire desirable attributes such as: analytical skills, curiosity and desire to learn, creative thinking, and the importance of teamwork (2, 3).

Thousands of native Arabs (citizens of the Arab Gulf States) have completed their engineering education at one of the eight public colleges (Table 1) of the Region, and have occupied government positions or joined the private sector, side by side with expatriates. Some have established their own business; and many have moved up the ladder into responsible managerial positions. In a recent attempt to poll some graduates of the Region’s colleges, on: the relevance of their engineering education, and any advice they may be willing to share? Majority expressed a moderate degree of satisfaction with the academic preparation they have received, but did point towards some negative aspects, that need to be addressed (11). Of particular interest here, are the negative impressions that many graduates have expressed with regard to the “classroom environment” they have experienced during their college years in the Gulf. Further, the desire of these Gulf graduates to see some changes and improvements in the methods of course delivery; have by far outweighed their wishes to modernizing courses’ content and/or curricula in general. Therefore, the impetus behind this paper has been, the remarks made and suggestions offered by these graduates, who have experienced some negative aspects of a “classroom setting”, as students of science and/or engineering in the Arab Gulf Region.

<table>
<thead>
<tr>
<th>Country</th>
<th>College of Engineering</th>
<th>Year Established</th>
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<tbody>
<tr>
<td>Saudi Arabia</td>
<td>King Saud University – Riyadh</td>
<td>Early sixties</td>
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<tr>
<td>Saudi Arabia</td>
<td>King Abdul-Aziz University - Jeddah</td>
<td>Early sixties</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>King Fahd University of Petroleum and Minerals (KFUPM) – Dhahran</td>
<td>Late sixties</td>
</tr>
<tr>
<td>Bahrain</td>
<td>University of Bahrain – Manama</td>
<td>Mid seventies</td>
</tr>
<tr>
<td>Kuwait</td>
<td>College of Engineering and Petroleum at Kuwait University - Kuwait City</td>
<td>Mid seventies</td>
</tr>
<tr>
<td>Qatar</td>
<td>University of Qatar – Doha</td>
<td>Early eighties</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>UAE University - Al-Ain</td>
<td>Early eighties</td>
</tr>
<tr>
<td>Oman</td>
<td>Sultan Qaboos University – Muscat</td>
<td>Mid eighties</td>
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Table 1. The Eight Engineering Colleges of the Arab Gulf Region
In Pursuit of a Positive Classroom Environment:

Institutional education, in broad terms, has three purposes: first, to pass on knowledge acquired through the ages— a process of “knowledge compartmentalization.” Second, to help students discover their own potential, and third, to equip them with the tools and skills to enable them to learn on their own. In undergraduate engineering education, we take it upon ourselves the task of transmitting the highlights (i.e., what is essential) of about one or more centuries of knowledge in four years. Thus students should be feeling a compression factor of at least twenty five.

Efficiency for teaching—often looked at in terms of cost and hence time—compels us to use a “one-way”, conveyor belt model for the transmission of knowledge. This situation precludes exploration by the student, allows little room for learning from failure, or for the student to assume ownership of the knowledge. The optimum approach for transmission of knowledge, as considered by many, is a linear sequential presentation of topics. Here, faculty teach courses in their own areas of expertise, often avoiding or ignoring connections to other bodies of knowledge, leaving the integration and synthesis to the student. This type of teaching leaves little room for the concurrent discussion and integration of multifaceted bits of information as it applies to the practice. At the same time, we can not ignore the fact that we have a limited time to impart all the knowledge we believe the student ought to be familiar with. We have often been accused of not making good use of class time, putting across irrelevant topic material, boring students with minor details, and not emphasizing the practice sufficiently. There is also a perception that engineering lacks social relevance or appear to have no conscience.

There have been laments about excellent students opting out of engineering, as they felt to be ill-prepared or incompetent because of the methods of teaching, the rigidity of the system, and the authoritarian approach in the transmission of knowledge. Often, these negative aspects of teaching, and the non-stimulating classroom environment, appears to impact the “second tier” students (i.e., those students who are serious about their learning and career goals, but who can be intimidated for a variety of reasons, and chose not to pursue engineering). Unlike “first tier” students (i.e., those students that will learn no matter how the class is conducted, or the course is taught), “second tier” students must not only do well, they must also feel good about their courses. They require and deserve more attention, more care, more time, and more support. They can get easily discouraged, lose interest, and eventually chose to opt out of engineering.

What are some of the strategies we may adopt that could help motivate “second tier” students, and make them more appreciative of science and engineering? The answer to this challenge is not simple, nor is it universal for every one; but there are some practical suggestions, if adopted, would invariably help students overcome some of their difficulties and increase their desire to do science and/or engineering. At the same time, these suggestions may aid instructors in: sorting out materials to be taught, help optimize class time, and increase students’ participation resulting in a more “caring environment.” These suggestions (i.e., ideas or activities) represent a mix of: modeling desirable behavior, pedagogical techniques, common sense, and general consensus from the experience of others. Finelli, Klinger and Budny have categorized activities that pertain to planning and conducting courses, and have also provided reference material about effective ways to structure learning, from a wide variety of educational sources. The essential conclusions drawn from multiple sources is that instructors, need to teach in context, and make
In the sections that follow, we examine the recommended strategies (activities, suggestions) that ought to be considered when teaching science and/or engineering subjects. And, in particular, those activities that are more relevant (i.e., applicable) to the Arab Gulf States.

**Course Planning:** To begin with, a course plan should be drawn up embodying instructor’s vision of what needs to be covered in the time allotted. A well-structured course plan would have four elements: a set of *instructional objectives*, a *course syllabus*, a fair and equitable *testing and grading policy*, and a “back up” scenario for slow learners and/or “potential switchers,” i.e., those that are hesitant about continuing in engineering.

1) *Instructional Objectives:* In broad terms, course instructors seek to impart new knowledge, help students learn new skills, encourage participation in class activities, and encourage students to acquire positive attitudes. The instructional objectives for the course can be prepared to reflect the required skills. When preparing instructional objectives, Robert Mager\(^\text{16}\) suggests some guidelines. He asserts that the objectives should include three elements: (i) a statement about what the learner must be able to do, (ii) a description of the conditions under which the performance is to occur, and (iii) a statement regarding the criteria for acceptable performance. James Stice\(^\text{17}\) states that “instructional objectives are the most important tool in the instructor’s kit, because they specify the outcome of the course.” Clearly, effort spent preparing instructional objectives pays off by providing the instructor with a clear vision of the purposes and goals of the course, allowing him and her to identify important subject matter, delete extraneous material, and aid in planning course activities. Further, when made available to potential students, the objectives provide a logical and coherent framework for the course and helps attract those that desire to enroll in it.\(^\text{15}\)

2) *The Course Syllabus:* The syllabus should provide, step by step detailed information, on how to achieve course instructional objectives. It should clearly communicate the course goals, list the subject matter to be covered in an orderly fashion with time allotted for each heading, list the textbook(s) and supplementary reference material, spell out the applicable grading policy, and address other course matters such as: lab work, recitation, field trips, and research papers. It should also list the instructor’s contact information and office hours, and should also provide some personal information with his/her views on “teaching-learning” issues, in an attempt to develop a rapport with the students. The burden falls on the instructor to try to know his/her students, and begin to establish a sense of community in the classroom.

3) *Testing and Grading Policy:* A testing and grading policy in a course, intended to measure student performance, must be consistent with the course goals and should be compatible with its instructional objectives. Although no universal guidelines exist on testing and grading policies; certain plausible rules regarding exams in general, may include the following: first, exams- at least at the undergraduate level-ought to be drawn from “main stream” material, the type that is usually anticipated rather than picking
“tricky” questions. Second, when administering a test, sufficient time should be allowed, commensurate with the level of difficulty and complexity of the subject matter. Third, the provision of a “make-up” test and/or a take home assignment, in lieu of a test, may be an option that could be exercised when students are known to suffer from “exam anxiety”.

Some of the students, particularly “second tier” tend to reject the “culture of competition” which emphasizes extrinsic rewards like getting good grades, or having objective goals like getting into graduate school. These students aspire for close working relationship with the instructor; they value learning through collaboration and discussion and tend to reject the “culture of competition”, normally associated with exams and obtaining good grades. It is imperative that instructors take into consideration students’ concerns when establishing the grading policy. Students need clarity and specificity in this regard; it is an important component of the course and should be properly addressed at the start. The course grading policy should take into consideration some likely questions such as: How often are tests given? What will be their nature? What percentage of the grade will depend on exams? How will other indicators (homework, participation, attendance, projects, etc.) be counted towards the grade?

It is equally important that the instructor provides periodic assessment of students’ performance during the semester. The intent is: (1) to alert those that have fallen behind, and at the same time, (2) motivate “achievers” to stay the course.

4) A “Back up” Plan to Assist Slow Learners and/or Potential Switchers: Many students are in engineering for a variety of reasons. Some are in because of peer pressure, or for other known or unknown reasons. They are not sure of their capabilities, having negative perception of the “class environment” and many of them are “potential switchers” (i.e., thinking of switching out of engineering). These “potential switchers” tend to have different learning styles, different expectations, different degrees of self-discipline, different “kinds of minds” from students who traditionally like what they are in for, do well in science and engineering subjects, and have a clear vision of where they are heading. Unlike the “potential switchers,” these students, referred to here as: “first tier,” are easy to deal with, believe in teamwork, get work done on time, and require minimal attention or supervision by the teaching staff.

It is clear that the group labeled “potential switchers”, require, and I would argue, deserve more attention, more information, and more support. It is up to the instructor, early on in the semester; to assess the situation, find out who are the “potential switchers”, devise a workable “back up” plan, and proceed to execute the plan. It is pivotal, at the start, to have some rapport with some of the students; and for the instructor to get to listen to what they have to say about the course (and any thing else on their minds). The instructor has to be generous with his/her time, and be willing to meet with students on a weekly basis. The crux of the plan can be a combination of the following tasks:(i) to reinforce information given during regular class time, (ii) to supplement the regular lecture material with applications, (iii) to simplify the harder concepts using different techniques, and (iv) to help instill a sense of community within the group- so that eventually, students, themselves, contribute to the plan by providing answers, ideas, and constructive criticism.
Equally important point is that the instructor should try to minimize students’ concerns and anxieties about tests and grades by discussing the matter with the students, and reminding them that they are in the course to learn and acquire skills; and their tangible reward is: the knowledge they gain. The instructor should also assure students, particularly those that seem to be most concerned about their performance in the course, that good grades are attainable with consistent output and honest effort.

Dudley Herschback’s pedagogical innovations in teaching chemistry, and, in particular, his handling of grading, is ingenious. He offers two unusual gifts to his students: first, his students are not to compete with each other, but rather they compete with a standard he, their professor, has defined; and if they do well, all of them can get “A”s in the course. Second, and even more innovative, is his lucrative offer of “resurrection points.” Any points not earned on a particular exam or quiz, during the semester, can be “resurrected” (i.e., made up) on the final. The idea is as follows: points a student misses on an hourly exam are logged on his or her record as “unearned points” in such a way that the corresponding section of the final is increased in value by that same number of points. Final exams then, in Herschback’s system, are individualized to account for previous difficulties and to reward compensatory work done by students between the hourly exam and the final. For the students, this plan translates into the possibility that, however poorly they performed prior to the final, they always have the opportunity to “ace” the course.

We have, so far, considered four essential elements in course planning, deemed necessary for organizing and executing the course. Ideally, the instructor should know the students before planning the course. However, in actuality, course planning comes first chronologically. Hence, the instructor should plan the course with all the competence in the subject area, and as many pedagogical considerations as possible, with built-in flexibility. The instructor must reflect on what the general objectives are, how they can be best achieved, and how the spectrum of topics that makes up the course content meets these objectives. After a few iterations of the course, one begins to understand the spectrum of students, and to modify some of the content and pedagogy to suit the diverse needs of the students. Each semester, the process of discovering the students (i.e., their needs, desires, and varied learning styles) and adjusting the course to meet new requirements, becomes a necessity.

**Course Delivery:** Conducting a successful course requires: organization, diligence, adherence to course plan, and proper apportioning of class time. Getting off to a good start is vital to both parties: the instructor and the students. The first session is an ideal opportunity for the instructor to convey his/her views of the course discussing: goals, topics, homework, projects, grading policy and the relevance of the course to students’ curriculum and their education in general. It is also important to relate in a clear manner what the instructor expects from the students, and how does he/she thinks it can be achieved. Also, the instructor, on the first day, may introduce the students to his/her teaching philosophy and discuss the significance of pedagogical activities (i.e., learning styles, learning to learn, teamwork, critical thinking). The instructor should try to “break the ice”, develop rapport with the students, and create a positive climate, thus allowing the students to approach the instructor, early on, with: questions, suggestions, impressions, etc.
To promote effective learning, in-class and out of class, course-related activities should be properly planned and executed. Almost all of the course activities are initiated, executed, and controlled by the instructor. Success in a course is attributed, in large measure, to the instructor (i.e., his/her care, his/her devotion to the teaching-learning process, his/her ability to promote confidence and community in the classroom). The elements, discussed below, are decisive in insuring success and promoting effective learning.

1) Classroom Setting and Instructor’s Role: In teaching his/her course, the instructor should apply the principles of “care” in executing the course in conformity with the syllabus. The instructor should plan what to cover in each session, how to cover it, and the pace at which it will be covered. The instructor should also make sure that the students comprehend new material, and that he/she is neither fast nor slow in delivering course material. The instructor should also show that he/she respects the students and class time by adhering to the start and stop times of the session, by not rushing through the material towards the end of the session, by avoiding irrelevant material, by eliminating unnecessary details, and by avoiding reading verbatim from the text as a substitute for “proper” teaching.

To enhance the success of the learning process, the instructor should stick to some golden rules in delivering the material such as: facing the students, looking them in the eye and establishing eye contact, and speaking slowly and clearly. If he/she is teaching for the first time and/or the topic is new to the instructor; he/she may have to resort to prior practice, in order to be sure that delivery is properly carried out. Since most students are unfamiliar with the material, the instructor may have to repeat some of what has been presented already, resort to different approaches in explaining the harder concepts, and enrich the presentation by using examples whenever possible. Language difficulties could arise, when the instructor and/or the student are not native speakers of English. The only solution to the English insufficiency is to learn English first, and attain an acceptable level of competency, sanctioned by an authorized department or agency.

In dealing with students, instructors should show care, respect, and good manners. They should set realistic expectations and give the students the benefit of the doubt. Instructors should refrain from talking down to their students, making them feel incompetent or unable to proceed with the course material. To the contrary, instructors should practice positive, optimistic, success-oriented teaching. They should encourage students to express themselves, ask questions, participate in open discussions, and be allowed to arrive at their own conclusions which may, at times, differ from those of the instructor. Instructors should strive to “humanize” the teaching experience, by being responsive to students and by focusing on teaching the students rather than only teaching the subject.

2) Additional Resources on Tap: A variety of known methods and resources are currently available, almost in every institution, which could be deployed to enrich teaching and learning experiences, and help the instructor in making better use of class time. Providing the students with xeroxed handouts of lecture material, is normally appreciated -since it
will reduce taking extensive notes during the class period; thus allowing students to concentrate on the material being presented.

Posting course-related material (home works, assignments, relevant reading material, etc.) on a website is extremely useful to students and instructor alike. Also, e-mail lists will help facilitate rapid communications between the instructor and the students, as well as among the students in the class. Proper use of e-mail lists will assist in planning course-related activities; by allowing information exchange and feedback. Making use of the internet, within the context of teaching-learning issues, is no substitute for face to face meetings during office hours, in the corridor, or during an informal gathering of the instructor and the students. It is merely a resource intended to augment and enliven the classroom experience.

General complaints about technical capabilities of engineering faculty are rare. However, many instructors need to improve their course delivery skills to help them in teaching and in engaging students. There are today, on many campuses, programs (workshops, short courses, seminars) that have been specifically developed to teach performance skills (communication skills, team performance, understanding of technical culture, and sensitivity towards diverse population) to the technical community, including young engineering faculty. The author is of the opinion that communication abilities, including proper teaching, do not develop by simply being in a classroom setting. The fundamentals of teaching and engaging students must be taught first, practiced, and then evaluated and enhanced with time, just like any other skill.

3) Making Room for Practical Applications: The present engineering curriculum for the most part can be categorized as being “conventional”. It is characterized by a normative and sequential approach, teaching general principles and methods before skills of application. Historically, the dominance of science in an engineering curriculum manifests itself in methods of selecting and solving problems. The tendency to simplify beyond real constraints, and to consider practical issues as impediments to a simple clean solution, is a deviation from the truth that needs to be rectified. To address this deviation, the instructor can introduce real applications, and could also draw on his/her own personal experience, or on the experience of practitioners who may be willing to contribute by presenting a real life problem to the class, when a slot is available. Additionally, students who have participated in professional work programs, community service, or academic-industrial partnerships, while in college, can be a valuable source of information that could add a practical dimension to the classroom experience.

Learning to analyze and understand real situations rather than simplifying away complexity is another characteristic of good engineering education. The main point here is that, as instructors, we need to teach “in context”, by bringing reality into the classroom, and making synthesis, evaluation, reflection, and decision making part of many of the courses we teach.

4) Learning from Examples: Another way to facilitate learning is through worked-out examples. A step-by-step example of a problem solution reduces the problem into several
sub-problems, where each can be analyzed separately. Then, try to see how to get from one step to the next. These types of made-up problems could be designed at varying degrees of complexity, commensurate with students’ standing and the skills they need to acquire. This is similar to taking a mechanical system apart (i.e., an engine, a motor) then attempt to put it back together, piece-by-piece. The learning aspects of such an exercise and the thought processes involved in insuring that the steps have to match and/or the parts have to fit, is what motivates the students to get to the right solution. Often students work together, as a group, under the supervision of the instructor- trying to look at the effect of different variables on the outcome; while attempting to piece together the various parts of the problem.

This approach to learning has been applied, rather successfully, to teach algebra in China. In several hundred Chinese middle schools, algebra courses are taught nowadays with no formal lectures. The skills are acquired mainly by having the students work out examples.\(^{(18)}\)

To further promote a successful classroom environment, the instructor should assess the progress of the course by reviewing assignments, tests, hand-outs, etc. and compare them with instructional objectives, to make sure that the course is proceeding as planned and on schedule. He/she should also make use of students’ comments and their written suggestions, which often are invaluable tools in streamlining and/or shaping the course direction.

Another important point is to periodically update the course content to reflect the evolving nature of engineering and technology. New discoveries, new theories, new materials, new computer-aided design programs, and new standards are some of the novelties that may have to be addressed in the course.

Learning Styles: One of the major objectives of ABET Criteria 2000 is the improvement of engineering education\(^{(10)}\) which would undoubtedly imply “effective” teaching (and learning). Teaching is effective when it recognizes students’ various learning styles, and deploys teaching (and learning) methods to stimulate students and engage them in the learning process. The term “learning style” may be described as: “biologically and developmentally imposed set of personal characteristics that make some teaching (and learning) methods effective for certain people but ineffective for others.”\(^{(15)}\) Various models of learning style preferences have been described. The most prominent ones are: the Myers-Briggs Type Indicator (MBTI),\(^{(19)}\) Kolb’s Learning Style Model,\(^{(20)}\) the Felder-Silverman Learning Style Model,\(^{(21)}\) and the Dun and Dun Learning Style Model.\(^{(22)}\)

The MBTI, based on Jung’s theory, has been popular in explaining differences in learning for normal people. The dimension of most interest for learning is sensing(S) versus intuitive(N) type.\(^{(23)}\) The sensing person prefers a straightforward, logical, step-by-step approach to learning. The sensing person often learns by solving problems, and tends to find theory difficult. The intuitive individual, on the other hand, will skip steps and follow hunches. He/she learns from theory and tends to do a minimal number of problems because they think they understand without having to solve problems.\(^{(24)}\)
Perry’s Model of College Student Development \cite{25} can also be used to monitor student learning. According to this model, which consists of nine positions (i.e., stages) occupying four general outlooks, people progress from positions 1 and 2, (dualistic), right versus wrong orientations to multiplicity (positions 3 and 4) where multiple answers are possible. Positions 5 and 6 are assigned to relativism where the person realizes that the world is relative with right versus wrong being a special case. Finally, people may reach stages 7, 8, and 9- these three stages represent commitment to value within relativism. Generally, students move up the scale (i.e., from 2 or 3 to 4 and 5) with gaining knowledge, maturity and experience.

Another useful way of considering student learning is to look at deep versus shallow approaches to learning. \cite{26,27} These two terms that describe learning, stem from a research in Sweden. \cite{23} Also, deep approach to learning has been connected to chemical changes in the brain which may result in lasting changes in cognition, attitude and character structure. \cite{28} In the shallow approach, students focus on learning isolated tasks often through memorization. The student’s goal is to be able to reproduce information; and does not focus on understanding but rather on superficial form. In the deep approach to learning, students focus on determining the meaning of what they are learning and how to connect information, which makes the learning holistic. Students who are intrinsically motivated prefer a deep approach, while extrinsically motivated students prefer a shallow approach. Almost every one is capable of using either deep or shallow approach to learning; however, people do have preferences. Those who prefer a shallow approach may find deep approach difficult. And those who are forced to use a shallow approach to learning would be annoyed and dissatisfied.

Some engineering educators argue in favor of adopting a learning style approach within a variety of teaching strategies, \cite{29} while others have preferred to look at the psychological implications of learning styles in specific educational domains. \cite{30} The author is of the opinion that engineering educators, today, should not overlook the extensive research that exists on learning styles. Educators should try to keep up with research development in the arena of learning/teaching styles, and attempt to use it whenever possible. To start, an instructor who is interested in developing his/her classroom skills should begin by discovering his/her own learning style. An interesting question is: How does the way you learn influence the way you teach? It is equally important to contemplate different approaches to accommodate different learners, particularly after having learned about one’s own learning style. An instructor with some understanding of differences in students’ learning styles is well on his/her way in making his/her teaching more effective.\cite{5}

A viable learning style model must be grounded in research, periodically evaluated, and adapted to reflect the developing knowledge base. \cite{22} Implementation of learning style practices must conform to accepted standards of ethics, and be carried out by competent instructors, who can provide suitable activities that appeal to each learning style. To promote effective learning, within the context of varied learning styles, it is important to form groups within the class. How do you form effective groups? How do you make groups work? What do groups do? The answers to these questions will differ from one course to another depending on: course type, course content, course level, prevailing culture, available resources, and applicable guidelines.
Research has shown that some learners have to express themselves openly in the class, and do 
desire personal interaction with the instructor and their fellow students. This type can forge ties 
easily with others, and sees his/her work and the outcome through the “group”. They are 
excellent participants and extremely successful in “teamwork”. On the other hand, there are 
those that seem to prefer learning on their own. They usually obtain information through abstract 
conceptionalization. These individuals are self-motivated, curious, like to test information, resort 
to trial and error in learning, and can learn by doing. If motivated, the latter individuals can also 
be active participants and often visualize themselves as group leaders (4,15). The task of forming 
groups in his/her course lies on the shoulder of the instructor who has to make sure that the 
formed group is: homogeneous, compatible, and that each and every group member has the 
opportunity to learn. The following statements, based on the work of Rita Dunn (22) and recast by 
Finelli, et al (15) provide explanations and add meanings to the concept of learning style from 
different perspectives.

- Each student is unique, able to learn, and has an individual learning style.
- Individual learning styles should be acknowledged and respected.
- Learning style is a function of heredity and experience, and develops individually 
over one’s life span.
- Learning style is a combination of affective, cognitive, environmental, 
developmental, and physiological responses that characterizes how a person learns.
- Individual information processing, fundamental to learning style, could be improved 
over time with practice.
- Learning style is a complex construct for which comprehensive understanding 
evolves.
- Learners are empowered by knowledge of their own and others’ learning styles.
- Effective teaching implies continuous monitoring to ensure compatibility of 
instruction with each individual’s learning style.
- Teaching individuals through their learning style strengths, improves their 
achievement, self-esteem, and attitude toward learning.
- Every person is entitled to counseling and instruction that is compatible with his/her 
style of learning.
- Applicable curriculum and teaching methods are learning-style based and 
personalized to address and respect diversity.

The practice of incorporating some or all of the elements listed above in an “engineering” course 
in which one is already faced with the problem of too much material in too short a time is 
daunting. But the challenge is exciting to any instructor who wishes to “humanize” the teaching 
(and learning) process, and reconcile within himself/herself that: he/she is teaching students 
rather than “unloading” teaching material in accordance with a time schedule.

Class Participation and Active Learning:

The instructor should be the proponent of class participation. He/ she is the instigator of grouping 
students, dreaming up activities and/or tasks that bring the students closer together, and insure 
that joint tasks are consistent with course objectives. The instructor must therefore have sincere 
interest in the students and must have the drive and capabilities to create (in and out of the 
classroom), an active learning environment. Active learning does imply class participation, i.e.,
the students, the instructor, and the teaching material are intertwined through preconceived and organized learning/teaching activities. Research in this domain has shown that what people tend to remember is highly correlated with their level of involvement. Edgar Dale’s cone of learning\(^{31}\) shows that students remember about 20% of what they hear, 30% of what they see; but tend to remember up to 90% of what they actively participate in, such as: discussions, questions and answers, dialogues, and hands-on activities. This is to say: the higher the level of student involvement, the greater is his/her comprehension and the higher is his/her retention.

Cooperative learning is “a formalized active learning structure which entails students working together in small groups to accomplish shared learning goals and maximize their own and each other’s learning.”\(^{15}\) Indicators have shown also that an active learning environment (including cooperative learning) impacts student’s personality very positively. It tends to boost self-confidence, improves communication skills, and makes the person a better team member. Cooperation will not be induced simply because students are physically near each other. It is actually a state of mind. A willingness to open up to others; exchange information and views with others, and accept the fact that working together is more beneficial to all involved in the exercise. For a cooperative learning experience to be successful, it is imperative that the following be integrated into the exercise and/or the class activity:\(^{15,32}\)

- Interdependence- Students should perceive that they need each other to complete the planned activity.
- Interaction- Students should work together in planning, executing, and arriving at conclusions. They should share the work load, and share the credit.
- Accountability- Each student’s role and performance is to be assessed, and the results are those of the group (and for the group). Keeping track of the contribution and knowledge gained by each member could be monitored by either testing each and every student in the group, or by randomly selecting a group member (or members) to be tested and thus proxy for the group.
- Sharing known skills- Students who possess certain knowledge or skills (examples: computer skills, laboratory skills, data reduction skills, presentation skills) should be willing to pass it on, and/or share it with their group members.
- Collaborative Skills- Groups cannot function effectively if members do not have (be willing to learn) or use some needed social skills. These skills include leadership, decision making, trust building, and conflict management.
- Monitoring Progress- Groups need to discuss amongst themselves whether they are achieving their set goals; they also need to prioritize the scheduled activities, introduce changes if need be, solicit advice and assistance with the consent of the instructor, and maintain effective working relationships among the members. Instructors also monitor group progress, give feedback on how well each group is doing, report each group’s progress to the class as a whole, and insure adherence to accepted standards of: ethics, social responsibility, and safety.

Success in implementing cooperative learning is attributable, in large measure, to: proper planning, efforts, dedication, and foresight of the instructor. Experience definitely is a major factor. A proper start for instructors wanting to try active learning for the first time (including cooperative learning) is to step into it gradually, and to seek continuous feedback as to how the course is going and how the students feel about it. In addition, he/she can tap into available
documented sources, attend seminars/workshops on the subject matter, and discuss planned activities for his/her course with experienced colleagues who can offer constructive comments and advise.

How do the particulars of this discussion apply to teaching/learning engineering within the Arab Gulf Region? How ready are the institutions in the Region to switch over from a “conventional” classroom setting to active learning? How should these institutions get started? And what prerequisites need to be in-place to bring about the needed “change”? We will address some of these questions in the sections to follow.

Pre-University Education in the Gulf Region: To try to understand today’s state of engineering education in the Region, it is important to understand a little of the Region’s pre-university educational system. The most significant change in the education system of the Region occurred in the decades of the 70’s and 80’s, as a direct result of the substantial wealth, derived from oil revenues, that found its way to the Region. Public schools, in particular, were substantially and positively impacted by the increase in revenues. The major improvements realized, as a consequence of increased funding, have included:(1) substantial increase in the number of well-equipped modern school buildings; (2) significant modifications to curricula and academic programs, in conformity with standards and guidelines prevalent (at the time) in some other Arab countries (Egypt, Jordan, Syria); (3) provision of qualified teaching staff drawn from neighboring countries; (4) improved management; (5) introduction of special education for physically and/or mentally challenged students; and, (6) the emergence of a more concerned general public with education issues.

Public schools, by and large, are under the auspices of the Ministry of Education who is solely responsible for planning, operations and budget. Hardly any difference exists among schools of the same category in any of the states of the Region. Admission policies, teaching materials, teaching methods, counseling, and testing and grading standards are nearly identical in all the public schools of the Region. Schools, at all levels, are free (i.e., free tuition, no fees, free textbooks) for Gulf nationals and expatriates alike. In addition, a stipend, equivalent to US $200 per month, is provided to most students that are in need.(2,3)

Despite the progress made and the many positive aspects that have been introduced to many facets of the K-12 educational arena over the last three and a half decades; there are those aspects that seemingly are extremely difficult to modify despite some efforts on the part of some concerned individuals. The main issue we are focusing on here is: the traditional methods of teaching that have persisted over many years and appears to be “immune to any change!” Practiced on a wide scale, the traditional approach embodies the following : (1) students are bombarded with information, drawn primarily out of the textbook(s); (2) students do not participate! The process is “one way,” with minimum interaction between students and instructor; (3) emphasis on rote memorization over all other kinds of learning has always taken precedence; and (4) most students study to get the grade rather than “to understand” and retain knowledge. Their shallow approach to learning is decidedly incompatible with engineering education, in general, and in direct conflict with the “ethos” of the engineering profession.
The main difficulty with pre-university education in the Gulf Region, as seen by both insiders and outsiders, is that it promotes rote and uniform learning over independent thought. In fact one can go as far to say, that it suppresses independent thinking. While these systems appear effective in developing students who are able to learn vast amount of “testable” information, it falls terribly short in fostering creativity, and analytical skills that are more difficult to monitor and test; the skills referred to here, are those that need to be acquired by students who wish to get into engineering. The author’s perception of some of the weaknesses and deficiencies in high school graduates, as they prepare to get into science and or engineering are listed in Table 2. As previously noted, the reluctance of decision makers to reform public education in the Region has continued to adversely affect outcome. Students finishing high school and applying to engineering are only marginally prepared. To rectify the current situation and rid the schools of the Region of the “malaise” that has gripped public education, at all levels; bold steps have to be taken by policy makers, i.e., to start a “transformation” process that will eventually do away with the existing “traditional” methods in favor of “student- centered” approach that has “active learning” as its prime feature.

- Inability to use math & science and /or to build on it (as a base) for engineering gateway courses.
- Thoroughly deficient in thinking critically and independently. Their thought process is totally confined to what they have been tutored to respond to.
- Inadequate communication skills.
- Inability to improvise and/or consider alternatives.
- Trained primarily to work as individuals. No experience working in groups.
- Encounter great difficulties: when integrating knowledge, when connecting previously acquired knowledge with more recently learned, in seeing interactions between different concepts, and in conceptualizing in general.
- Do lack the drive, the patience, and the discipline to perform independent work.

Table 2. Author’s Perception of Weaknesses in High School Graduates Applying to Engineering.

Moving Forward with Active Learning in the Gulf Region: Despite the inadequacies of the pre-university systems in the Region and the inability of schools (in their present state) to equip the graduates with the desirable “tools” that beginning engineering students ought to possess at the start of their journey; active learning and compliance with students varied learning styles should infiltrate lower division college courses (freshman & sophomore) as soon as possible! To “seed” the process and insure that it will have the “fertile ground” it needs to grow and spread properly, a few well-seasoned and experienced instructors (who are firm believers in “active learning”), should be the instigators. And as the saying goes, “Later better than never.” There will always be those instructors who have the self-confidence; the foresight, the drive, and the desire to assume a leading role. It may start with a limited number of courses; but the number is likely to increase with time, as it gains wider acceptance among students who are the primary beneficiaries of this transformation.

The general objectives of such a transformation in the “teaching-learning protocols” are:(i) to ensure that the students emerge with the traits and skills that industry has always insisted on; (ii) that the students (and therefore graduates) be able to employ these traits and skills in real
contexts as professionals; and, (iii) that students (and therefore future graduates) become independent learners, think critically of course material, learn to work in groups as well as independently, and acquire decision making skills.

Industry in the Region needs to seek a stronger voice in academia, particularly visa-a-vie engineering. It is not enough for industries in the Region to be an “on-lookers,” i.e., looking from the outside in! Time has come for the industry to play an active role and start becoming a partner in “shaping-up” engineering education in the Region. Its current practices of limiting its role to training and employing some graduates (most of them inadequately prepared) to gain favors or maintain an agreed upon quota (i.e., the current set up of hiring nationals versus hiring more desired and far better qualified expatriates), is self-defeating to say the least.

What appears necessary, within the context of industry-academia relationship, is for the industry to exert pressure on academia to reform, and thus prepare their engineering graduates more adequately for the challenges ahead. Would the pressures, if and when exerted by the industry in the Region, initiate the desired “reformation” in education? Will this “reformation” include a shift in engineering education toward the adoption of active learning, and thus tangible improvements in classroom environment? These questions can only be answered when the colleges of the Region begin to deal with their current challenges.

Summary and Concluding Remarks:

The current phase of engineering education in the Arab Gulf States (Saudi Arabia, Kuwait, Bahrain, Qatar, The United Arab Emirates, and Oman) has many of the symptoms that “beset” institutions, in their natural sequence of progression. “Reformation” and “restructuring,” regarded by many as part and parcel of the renewal process, appear to be much more difficult to implement in the Arab Gulf Region in comparison to western countries.

The present state of engineering education in the Region suffers from: the persistence of “traditional” approaches to teaching, inability to modernize, future uncertainties, and “deficient” public school systems that have failed to equip the graduates with relevant personal traits and skills essential in engineering education.

The main focus in the paper is on strategies for improving the classroom environment, and exploring ways and means of shifting gradually into “active learning” with emphasis on students’ varied learning styles. There are several different approaches to improving a classroom environment and Tables 3 through 5 list most of those elements (steps, activities) identified as potentially appropriate for colleges in the Region. In particular, activities pertaining to: i) planning courses, ii) conducting courses, and iii) imparting positive learning environment in and outside the classroom, have been explored.

Furthermore, the paper looks also into the role that the industry in the Region could play in reforming engineering education in the Region. What seems necessary is to influence the industry to exert pressure on the educational institutions, demanding that “reformation” should include a shift in engineering education toward industrial relevance.
In conclusion, what colleges of engineering in the Arab Gulf States should aspire for is: a dynamic, forward-looking educational framework that fosters constant renewal and is in tune with prevailing social and cultural realities. Alongside, a more liberal classroom setting that features active learning, care, and accommodates students varied learning styles.

<table>
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<tr>
<th>Course Planning</th>
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<tr>
<td>• Prepare instructional objectives.</td>
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<td>• Develop syllabus to outline subject matter and communicate goals.</td>
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<tr>
<td>• Adopt a proper testing and grading policy consistent with instructional objectives.</td>
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<tr>
<td>• Provide a “backup” plan to assist slow learners and/or potential “switchers.”</td>
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Table 3. Suggested Course Planning Tasks for Improving the Classroom Environment.

<table>
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<tr>
<th>Course Delivery</th>
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<tbody>
<tr>
<td>• Apply the principles of “care” in delivering the course.</td>
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<tr>
<td>• Make use of available resources (i.e., website, e-mail lists, xeroxed handouts, etc) to optimize class time, and reduce unnecessary class notes.</td>
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<tr>
<td>• Respect students’ time in classroom.</td>
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<tr>
<td>• Utilize alternative methods in delivering course material.</td>
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<tr>
<td>• Set an appropriate pace in delivering the course; not too fast, or too slow.</td>
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<td>• Draw on personal experience and the experience of outside speakers.</td>
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<tr>
<td>• Make use of practical applications and worked-out examples whenever possible.</td>
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<tr>
<td>• Make a concerted effort to relate the course material to real life problems.</td>
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<tr>
<td>• Set up ample office hours, and be available and prompt.</td>
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<tr>
<td>• Update the course content from time to time to reflect the evolving technology.</td>
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Table 4. Some Suggested Steps in Course Delivery to Help Improve the Classroom Environment.

<table>
<thead>
<tr>
<th>Students’ Participation and Learning Styles</th>
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<tr>
<td>• Make a concerted effort to know the students.</td>
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<td>• Encourage students to be “active” participants.</td>
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<td>• Solicit students’ feedback and respect their opinion.</td>
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<td>• Attempt, early on, to let the “teaching/learning” be a “two-way” approach.</td>
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<tr>
<td>• Encourage students to “open up” to the process and try to understand their learning style whenever possible.</td>
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<tr>
<td>• Encourage students to work in groups whenever appropriate.</td>
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<tr>
<td>• Provide suitable activities that appeal to most learning styles.</td>
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<tr>
<td>• Try, through selected activities, to see to it that a sense of “community” develops within the classroom.</td>
</tr>
<tr>
<td>• Calm down those who suffer from exam anxiety, and work out alternatives if anxieties persist.</td>
</tr>
<tr>
<td>• Consider using “cooperative learning” after careful planning.</td>
</tr>
</tbody>
</table>

Table 5. Suggested Steps to Encourage Students’ Participation and Active Learning.
Bibliography:


Biography:

WADDAH AKILI

Waddah Akili has been in the academic arena for over 35 years. He has held academic positions at Drexel University, Philadelphia, Penna (66-69), at King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia (69-87), and at The University of Qatar, Doha, Qatar (87-00). Professor Akili’s major field is geotechnical engineering and materials. His research interests & experience include: characterization of arid and semi arid soils, piled foundation, pavement design & materials, and concrete durability. He has been interested in contemporary issues of engineering education in general and those of the Middle East in particular.