AC 2008-349: ON ENGINEERING EDUCATION IN THE ARAB GULF STATES: STUDENTS' ENGAGEMENT THROUGH COOPERATIVE LEARNING STRATEGIES

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Abstract

Engineering education in the Arab Gulf States (the Region) faces significant challenges as it seeks to meet the demands on the engineering profession in the twenty first century.
This paper focuses on classroom-based pedagogies of engagement, and *cooperative learning strategies* in particular. The paper is a follow up to previous work by the author, on viable strategies to improve the classroom environment of engineering colleges in the Region. At the start, the paper provides an overview of relevant benchmarks of engineering education in the Region. Then, relates author's preliminary findings on *teaching/learning* practices in engineering colleges of the Arab Gulf States, sheds light on the *pros and cons* of the *lecture format*, and examines the literature on meanings and substance of different *active learning* protocols focusing on *cooperative engagement strategies*. Next, it identifies common barriers to *reformation* in general, and to the use of modern pedagogical skills in particular. The paper also argues that any meaningful change in Region's classroom practices today (dominated by traditional lecture-based methods) must be mandated and supported by the university administration. What is necessary to create a change, is for the department or college, to have a comprehensive and integrated set of components: clearly articulated expectations, opportunities for faculty to learn about new pedagogies, and an equitable reward system.

Introduction

"To teach is to engage students in learning." This quote, from *Education for Judgment* by Christenson et al, [(1)] captures the meaning of the art and practice of pedagogies of engagement. The theme advocated here is that student involvement is an essential aspect of meaningful learning. Also, engaging students in learning is principally the responsibility of the instructor, who should become less an imparter of knowledge and more a designer and a facilitator of learning experiences and opportunities. In other words, the real challenge in college teaching is not trying to cover the material for the students, as many of us believe and practice today; but rather uncovering the material with the students! This is a call for all faculty involved with teaching engineering courses and as members of faculty teams who develop, maintain and implement engineering programs , to consider not only the content and topics that make up an engineering degree but also how students engage with these materials. It is primarily a call to consider how students engage in their college experience, and to search for proper tools that can be deployed to stimulate learning.

In moving forward, there are numerous tools available to select from, including the models predicated on cooperation; i.e., working together to accomplish shared goals. Within *cooperative* activities, individuals seek outcomes that are beneficial to them and also benefit all other group members. [(2, 3)] *Cooperative learning* researchers and practitioners have shown that positive peer

relations are essential to success in college. The positive interpersonal relationships promoted through *cooperative learning* are regarded by most as crucial to today's learning communities. They increase the quality of social adjustment to college life, reduce uncertainties about attending college, and increase integration into college life. Isolation and alienation, on the other hand, often lead to failure. Two major reasons for dropping out of college are: failure to establish a social network of classmates and failure to become academically involved in classes. [4, 5]

In the Arab Gulf States (Saudi Arabia, Bahrain, Kuwait, United Arab Emirates, Qatar, and the Sultanate of Oman) traditional methods of teaching/learning dominate the classroom environment. Calls by some academics to introduce *pedagogies of engagement* have not been effective in changing the "mind set" of most stakeholders. Therefore, the traditional mode of lecture where the information passes from the notes of the instructor to the notes of the students - without passing through the mind of either one - continues as "the norm".

The purpose of this paper is to renew the call for deployment of better and more effective instructional strategies in the classrooms of the Arab Gulf States, stressing on *cooperative learning* practices as a viable alternative to the traditional (low-interaction lecture-based) environment that has gripped the engineering education of Region's institution for decades. The paper sheds light on: theoretical roots, research support, current practices, and suggestions for redesigning classes-if need be- to stimulate interaction and help break the traditional lecture dominant pattern when *cooperative learning* protocols are deployed. The paper shows how *cooperative learning* can advance academic success, quality of relationships, psychological adjustments, and attitudes toward the college experience. A number of relevant questions do come to mind, including: What needs to be done to move the process forward? What are the key components of successful deployment of *active learning* in general and *cooperative learning* in particular? How to foster and expand the community of engineering faculty who decide to use *cooperative learning*? What plans and resources need to be mobilized to institutionalize pedagogies of engagement including *cooperative learning*, at the department or college level? Achieving the change needed in engineering education across the Region does require a collective effort by all involved in the process, namely: the institution, the faculty, and the students.

An Overview of Engineering Education in the Arab Gulf States

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. [6, 7, 8]

Engineering education in the Arab Gulf States (the Region beamed at here) started, in earnest, during the early to mid sixties. Initially, colleges of engineering were founded in Riyadh, Jeddah, and later, in Dhahran, Saudi Arabia. In the other smaller states of the Region, engineering colleges were founded soon after these states have gained their independence. [6, 7, 8]

The strong political and economic ties between the States of the Region and western countries- the USA in particular - 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 main public colleges of engineering in the Region (Table 1) in addition to several, recently established, private and semi private colleges and/or universities that offer engineering degrees.

These eight public colleges (shown in Table1), have since their inception, been guided by advisory committees made up largely from experienced faculty members and administrators drawn from US colleges. Previously, the Grinters Report [9] and the Goals Report [10] have been used to guide the educational process. Recently, ABET Engineering Criteria 2000[11] 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 in the Region. Whether or not it will be fully implemented, would depend on: institutional vision and commitment to reformation, available resources, students' preparedness, and prevailing traditions and norms.

Country	*College of Engineering*	*Year Established*
Saudi Arabia	King Saud University – Riyadh	Early sixties
Saudi Arabia	King Abdul-Aziz University - Jeddah	Early sixties
Saudi Arabia	King Fahd University of Petroleum and Minerals (KFUPM) – Dhahran	Late sixties
Bahrain	University of Bahrain – Manama	Mid seventies
Kuwait	College of Engineering and Petroleum at Kuwait University - Kuwait City	Mid seventies
Qatar	University of Qatar – Doha	Early eighties
United Arab Emirates	UAE University - Al-Ain	Early eighties
Oman	Sultan Qaboos University – Muscat	Mid eighties

Table 1. The Eight Main Engineering Colleges of the Arab Gulf Region

The public colleges of engineering – the eight colleges shown in Table 1 - are part of the public university systems of 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 improving their English skills [7, 8]. The author has proposed to reform the "prep year" by making it two years, 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", to help students acquire desirable attributes such as: analytical skills, curiosity and desire to learn, creative thinking, and the importance of team work [7, 8]

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 since 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 **survey** directed at graduates of engineering colleges of the Region on: the *pros and cons* of the engineering education they have received, and any advice they may be willing to offer? **Fifty seven** out of a total of **sixty five** respondents were critical of the classroom environment and teaching styles practiced during their college years. The majority of the respondents- at the time of the survey- were between 25 to 30 years of age, citizens of the Gulf States, and either employed or practicing engineering in the Region on their own. [12]

The ***Survey***, aimed at getting first hand information from the graduates on a number of topics, including: (i) curricula, classroom environment, and *teaching–learning issues*; (ii) alumni-college relations; and, (iii) industry–academe relationships, as perceived by the graduates. Of particular interest here are the remarks made and arguments presented by the respondents, on the need to replace *traditional teaching* that has persisted, with better more effective methods of course delivery. [12]Therefore, the impetus behind this paper has been the views expressed 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 Gulf Region. Majority of respondents have come to the realization, after having finished college, that learning is not an automatic consequence of pouring information into a student's head. The process should have an enduring value beyond the classroom! It was also a call for the colleges of the Region to begin transforming learning and teaching, by sponsoring new initiatives that will seed, promote, and encourage faculty to adopt "classroom–based *pedagogies of engagement*"; particularly *cooperative* and *problem-based* learning. This raises a general question: How can the Region, as one entity, promote systematic change to the educational process, taking advantage of the wealth of available information on *teaching and learning*? There is no easy answer. But, developing a new cadre of engineering faculty who are comfortable using novel *engagement strategies* would be a step in the right direction.

Teaching/Learning Practices in the Region: Preliminary Findings Launched in 2007

To get first-hand information on teaching practices and classroom activities in the colleges of the Region, the author traveled - during the spring of 2007- to the Region and was able to meet with faculty members and administrators from three engineering colleges, in an effort to learn about current teaching and learning practices, and instructors' views on ways to improve the classroom environment in the Region. A total of 24 faculty members responded voluntarily – on a rather short notice - and expressed their views orally, supplemented with written statements. The main headings/questions raised by the author, during the interviews, were:

- Have you been exposed to *active teaching/ learning strategies,* and have you kept up with recent developments in the arena of *pedagogies of engagement?*
- Are you willing and able to deploy any of those strategies (*pedagogies of engagement*) if and when the need arises?
- If you were to select one such *strategy* which one would it be? And why?
- Preliminary information reveals that *strategies of engagement* are not currently utilized in the Region, at any level, Why not?
- Do you believe that *active learning strategies* should be deployed in your department and/or college? And if so, what are the barriers?
- Based on your experience, what would you suggest to add or change in your teaching strategies that would improve the classroom environment?

While answers to the above noted questions varied considerably from one member to the next; there were, nonetheless, some agreements amongst many, on certain issues that would be worthy of consideration. The general consensus of views/opinions expressed by the majority of the faculty interviewed by the author asserts and/or amplifies the following points:
First, nearly all faculty members have been exposed to one form or another of *active learning* through work shops and seminars offered at their universities' Learning Centers. Some have acquired the knowledge on their own, i.e., through their own personal endeavors. ***Second,*** all have expressed their wish to learn more about *active learning strategies*; and most do not believe that they are sufficiently competent to deploy an *active learning strategy* as yet; in the courses they will be responsible for in the near future. ***Third,*** with regard to the strategy they would chose or deploy, the majority had no specific preference, and have argued that a specific method is best viewed as "a good choice" only when placed within a context that considers the overall experience and outcome, including: goals and objectives, the nature of the subject, and the capabilities and readiness of the students to embark on a new undertaking. ***Fourth,*** many have expressed their wish to improve their classroom strategies within the framework of traditional methods, arguing that there is a great deal of room for improvement within the traditional lecture approach. ***Fifth,*** some members have stressed the point that the success of any *active learning strategy* requires students' active participation, raising the question whether students are ready and willing to become active participants in the process? ***Sixth,*** most faculty members were mindful of the time and energy required to become a more effective instructor; and, at the same time, apprehensive and concerned that teaching is often undervalued in comparison to research.

The interviewed faculty members have been teaching undergraduate classes at their present institutions for a minimum of five years. Most of the classes taught by the aforementioned

faculty are small size, seldom exceeding 35 students per class. The lecture format dominates the seen. Students listen, take notes, and are allowed to ask questions at the end of the lecture or during office hours. There seem to be less interest (by most of the faculty interviewed) in the process by which the course content is delivered during the lecture period, and more of a concern whether the rate of delivery would allow the instructor to finish the course on time. The views expressed by the faculty and the impression(s) arrived at by the author, leads one to believe that it is highly unlikely that new more effective *teaching-learning strategies* would be deployed any time soon, unless drastic measures are undertaken. The author is more convinced now than ever, that classroom reformation, including deployment of *active learning strategies*, would happen only if the institution mandates it!

The Pros and Cons of the Lecture Format

When asked why he lectures, one faculty responded: *"It is tradition. It was part of my training, and seems to dwell in me and seems like what I should be doing. I feel guilty when I am not lecturing"* [(13)]. This candid statement suggests one of the great dilemmas faced by all who teach at the postsecondary level. Lecturing is virtually synonymous with teaching. It was the dominant method by which we were taught - and it is the method by which most of us teach. When discussing potential change in current *teaching–learning* strategies, many faculty members become defensive, and discussions may quickly degenerate into heated debates where sides are clearly drawn. Over-exuberant advocates of *active learning* have, unfortunately, not been able to persuade the majority of us who have grown accustomed to traditional teaching methods. More efforts and better approaches in persuading the traditionalists appear necessary. Better is an alternative approach that recognizes that one's choice of an instructional method is best viewed as appropriate or inappropriate only when placed within the context that considers the professor's specific objectives, the complexity of the subject matter, the physical setting of the classroom, and the capabilities of the learners. The challenge is to choose a suitable method at the appropriate time. Understanding the *pros and cons* of the lecture method is a helpful starting point.

Lectures have a number of characteristics that does make them, for the right subject matter, desirable in the classroom. [(14)] It does, to a great extent, depend on the abilities and experience of the lecturer. An able and committed lecturer can accomplish the following:

1. Relate the material proficiently and effectively, in a manner that reflects lecturer's personal conviction and grasp of the subject matter;
2. Provide students with a thoughtful, scholarly role model to emulate;
3. Supplement the subject matter with current developments not yet published, or interject lecturer's own views derived from his/her own experience whenever applicable;
4. Organize material in ways to meet the particular needs of a given audience;
5. Efficiently deliver large amounts of information when the need arises without confusing his/her audience;
6. Underscore key points, simplify complexities, illustrate with facts and figures, and arrive at well "thought-out" conclusions.

In addition, lectures are presumably cost-effective in that they can reach many listeners at one time, they present a minimum threat to students in that they are not required to actively

participate, and they provide an advantage for those students who find learning by listening enjoyable[14].As most students will attest, not all lectures or lecturers achieve these goals. Research findings suggest that a number of identifiable attributes must be implemented to make a lecture truly effective. For instance, students remember material presented at the beginning of a lecture better than information presented in the middle or at the end of the lecture. Also, the effectiveness of the lecture varies inversely with the difficulty of the material presented, and listeners retain factual material better when presented in short sentences rather than in long sentences. Speaking extemporaneously is more effective than reading from lecture notes, and it is desirable to change the pitch, intensity, and timbre of one's voice [15]. These characteristics presume that the lecturer is an enthusiastic and knowledgeable scholar. But, we realize that most campuses have a few that fit this description, and can be labeled as gifted practitioners who could keep most students interested during the formal 50- minute lecture. Even if it is assumed that most engineering lecturers possess these necessary characteristics, research has shown that *the exclusive use of the lecture in the classroom constrains students' learning.*

One of the most important problems associated with *total* reliance on the lecture method is the inability of most students to listen effectively to any lecturer, no matter how skillful, over a sustained period. Research on the learning experiences of college students exposed to straight lecturing found that after an initial settling-in period of a few minutes, students readily assimilated materials for the next five minutes or so. Ten to 20 minutes into the lecture, however, confusion and boredom set in and assimilation fell rapidly, remaining at a low state until a brief period toward the end of the session when students were revived by the knowledge that the lecture would soon be over [16].There are too many reports in the literature on lack of concentration by the audience, even when the lecturer is brilliant and the attendees are highly motivated, including medical students [14]. When it comes to "note-taking" during a 50 minute lecture, research has shown that students have noted 40 percent of the content presented during the first 15 minutes, 25 percent of the total content in a 30 minute-period, and only 20 percent during 45 minutes[16]. Research also suggests that the relative effectiveness of a lecture depends on the educational level of the audience. "In general, very little of a lecture can be recalled except in the case of listeners with above average education and intelligence" [15].Even with bright, competent students listening to an interesting topic presented by a knowledgeable speaker, several serious problems remain, including the following:

1. Course content is often presented via lecture in unorganized and uneven fashion. This makes it difficult for students to determine the most important aspects of the lecture (i.e., what's going to be on the exam?);
2. Many college students do not know how to take effective notes. Although various strategies and formats for effective "note-taking" have been identified. The fact is that "note-taking" is seldom taught;
3. The listening, language, and/or motor skill deficits of some students make it difficult for them to identify important lecture content and write it down correctly and quickly enough during a lecture;
4. Instructors sometimes get off-track from the primary objectives of the lecture. Professors—especially those who really know and love their disciplines—are famous for going off on tangents during lecture. Although getting off-track would break the

monotony, it could make it difficult for even the most skilled note-takers to determine the most important content.

For those instructors who would like to go beyond the traditional methods of lecturing, a number of effective strategies promoting *active learning* are available to choose from. If a faculty member is hesitant about selecting one or more of these *active learning strategies* because some questions exist about its comparative effectiveness with the lecture method, he or she should consider the following: research has shown, beyond the shadow of doubt, that these strategies do deliver content as well as lectures while providing diverse presentations that enhances students' motivation and achievement, and helps in building up desirable personal traits.

Examining the Literature on Meanings and Substance of Active Learning

It is difficult to come to grip with all the cited definitions, meanings, and interpretations of the term *"active learning"*, since different contributors in the field have interpreted some terms differently. However, by gleaming at the literature, it is possible to arrive at general consensus of what appears to be widely accepted definitions, and to shed light on how common terms are used today.

Active Learning is generally defined as any instructional method that *engages* students in the learning process. It is widely accepted that *active learning* requires students to take part in "pre-planned" learning-related activities, believed to spark and stimulate their learning, while in the classroom.[17] These activities would include: reading, writing, solving problems, answering questions, participating in a discussion, etc.; and most important, students must be engaged in thinking tasks while actively involved. It is generally understood that during *active learning*, less emphasis is placed on transmission of information and more on developing students' skills. Additionally, during an *active learning* cycle, emphasis is placed on students' exploration of their own abilities, including: their thinking process, their value system, their intellect, and their courage to express themselves orally and in writing. *Active learning* is contrasted to the *traditional lecture* where students passively receive information from the instructor. [17, 18, 19, 20]

Collaborative Learning refers to any and all of the instructional methods where students work together in small groups towards a common goal.[20] It can be viewed as encompassing all group-based instructional methods, including *cooperative learning*.[20,21,22] However, some researchers view *collaborative and cooperative learning* as having two distinct historical developments and differing philosophical roots.[23]Despite differences and similarity of the two approaches (*collaborative vs. cooperative*), the fact remains that the core element of both, is the emphasis on student interactions, as the primary source of learning, rather than learning as individuals.

Cooperative Learning is a formalized active learning structure where students work together in small groups to accomplish shared learning goals and to maximize their own and each others learning. The most common model of *cooperative learning* in engineering is that of Johnson, Johnson and Smith. [24, 25] This model has five specific elements: mutual *interdependence*, individual *accountability*, face to face *interaction*, *interpersonal* and small group *skills*, and individual *assessment* of group *functioning*.[24] Although different cooperative models exist,[26]

the core element in all of these models is the emphasis on cooperative incentives rather than competition in the promotion of learning.

Problem-based learning (PBL) is an instructional method where relevant problems are introduced during the course to provide the context and motivation for the learning that follows.[27] PBL, by and large, is self-directed learning that helps develop positive student attitudes, foster a deeper approach to learning, and helps students retain knowledge longer than traditional instruction. It is appropriate here to mention that several approaches go under the name of *Problem-Based-Learning*. These known approaches to PBL have as many differences as they have elements in common, making interpretation of outcome rather difficult.[28]

Before adopting a specific method of *active learning*, faculty members need to become familiar with the literature and, in particular, the various strategies that promote *active learning* in the classroom. Despite familiarity with the literature, ambiguity and confusion may result, at times, from reading the literature; particularly when the effectiveness of any instructional method is examined and/or compared with another method. Assessing "what works" requires looking at a broad range of learning outcomes, interpreting results carefully, and quantifying the magnitude of any reported improvement. To assess critically "what works" for a given set of conditions, the reader has to attain sufficient knowledge and familiarity with the subject matter.

Reported studies, by and large, tell us about success stories and seldom reveal what has not worked! Irrespective of how data, results, and interpretations are presented in the literature, faculty adopting a specific method with the expectations of experiencing similar results to those in the literature, should be aware of the limitations of any reported piece of research, i.e., such reports may not reveal all factors and details; and therefore, extrapolating without a thorough investigation could be misleading. This should not, by any means, discourage faculty from moving toward *active learning*; but rather intended as a "precautionary" observation, to new instructors: Not "to make too much" out of what they have read unless it is credible, thorough, and substantiated with facts and figures. Despite some pitfalls, engineering faculty should be strongly encouraged to examine the literature on *active learning*, including: the empirical research on its use, and the common obstacles and barriers that may arise as a consequence of its application.

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Promoting Student Engagement Using Cooperative Learning Structure

As noted earlier, relying solely on the traditional lecture approach, no matter how competent the lecturer is, fails to *engage students in learning* thus indirectly depriving students of learning experiences and opportunities that could only materialize utilizing *engagement strategies*.

Under the umbrella of *engagement strategies*, there are numerous models available to select from, including the models predicated on cooperation - working together to accomplish shared goals. Within *cooperative* strategies individuals seek outcomes that are beneficial to themselves and beneficial to all group members within the class.[2, 3]The work by Johnson, Johnson, and Smith[2,3] indicates that students exhibit a higher level of individual achievement, develop more positive interpersonal relationships, and achieve greater levels of academic self-esteem when participating in a successful *cooperative learning* environment.

Cooperative learning researchers and practitioners have shown that positive peer relations are essential to success in college. The positive interpersonal relationships promoted through *cooperative learning* are regarded by most as crucial to today's learning communities. They increase the quality of social adjustment to college life, reduce uncertainties about attending college, and increase integration into college life. Isolation and alienation, on the other hand, often lead to failure. Two major reasons for dropping out of college are: failure to establish a social network of classmates and failure to become academically involved in classes. [29, 30]

Cooperation is more than being physically near other students. 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 class activity :[30, 31, 32]

- Positive Interdependence- Students should perceive that they need each other to complete the planned activity.
- Face to Face Interaction- Students should work together in planning, executing, and arriving at conclusions. They should share the work load, and share the credit. Thus promoting each others learning.
- 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, as well, 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.

Barriers to Change in the Classroom

To address adequately why most faculty in the Arab Gulf region have not embraced recent calls for educational reform, it is necessary first to identify and understand some common barriers to instructional change that seems to apply in America and elsewhere, and have been reported on in the literature [(14)]. Many of these barriers seem applicable to the institutions of the Region, including:

- The powerful influence of educational tradition,
- The discomfort and anxiety that change creates,
- Faculty self-perceptions and self-definitions of roles,
- Lack of well-defined incentives; also, lack of proper guidance for faculty to embark on the change.

There are also specific obstacles associated with the use of a new format in teaching, i.e., for example, using *pedagogies of engagement* approach:

- The potential problem/difficulty that may result from not covering adequately the assigned course content in the limited class time available;
- The increase in the amount of preparation time;
- The lack of needed resources to proceed with the new method, when applicable;
- The difficulty of using *active learning*, or any variation thereof, in large classes.

Perhaps the single greatest barrier of all, is the fact that faculty members' efforts in employing a new approach would involve risk- the risk that students would not participate, or learn, the fact that faculty members may feel a loss of control, lack necessary skills, or be criticized for teaching in unorthodox ways.

Faculty universally "know" that their institution expects excellence in teaching, but relatively few campuses have critically examined and discussed explicitly how "excellence" is best achieved and assessed. Research has shown that faculty perceptions about the underpinnings associated with "superior teaching" clearly place "knowledge of the subject matter" well above all other considerations. [(33)] A provocative analysis of metaphors about teaching and learning in higher education describes the "Container- Dispenser model."[(34)] Knowledge is a substance, material, or source of power, instructors are containers (filled with content, material, and facts), and students are vessels (wanting to be filled up). It seems apparent that faculty whose view of teaching and learning could be represented by the "Container-Dispenser model" would be especially concerned about covering content. If it is the only goal, then skillful lecturing can readily be understood as an important means to this end.

A. The feedback circle in the classroom: Faculty and students share many expectations regarding the proper role that each plays in teaching and learning, those perceptions having been formed in traditional classroom settings. For example, many faculty members are very specific about how they learned to teach, "modeling" themselves based on their own experiences from their student days. Most can not point to a powerful role model in their past who consistently and

skillfully used *pedagogies of engagement* in the classroom. For this reason, if no other, it is not surprising that faculty seldom use strategies promoting engagement practices.

Students' resistance is another element of the feedback circle. Some students will always resist the use of *pedagogies of engagement* because of their contrast to the more familiar passive listening role to which they have become accustomed. Listening to faculty talk is not only familiar to students; it is also a considerably easier one! Often, and as noted in the literature, students do communicate their displeasure with nontraditional instructional approaches, which in turn encourages the use of more traditional teaching methods. [14] Students' maturity, academic growth and intellectual development play a major part in their response to unfamiliar and novel teaching and learning strategies. The work by Perry [35] suggests that "dualistic learners" want structured lectures in which faculty describe clearly and precisely what they need to know. Such students expect the instructor to maintain control over the class and to simply present the facts; they believe that a student's role is to pay attention, to take notes, and to memorize the material presented. "Dualists" typically find class discussions confusing and a "waste of time." Chances are that only in a later stage of intellectual development- the relativism period- students begin to assume responsibility for their own learning, view class participation as an exciting opportunity to exchange differing perspectives, and become willing to participate and critique each other. What would it take to entice students to become active participants at an early stage? Undoubtedly, pre- college exposure to *pedagogies of engagement* – if at all possible- would lighten the burden on faculty and students in adopting and implementing *active learning pedagogies* in college.

B. Feelings of discomfort, anxiety and indecisiveness: Experiencing some degree of discomfort and anxiety in response to one's initial attempts to try something new is probably a universal trait. So it is when faculty consider trying new and different ways of teaching. Faculty resistance to change in their classroom practices is the norm. Professors tend to be conservative, favoring old, tried-out methods and viewing innovations of any kind with considerable apprehension. Little evidence exists today to suggest that the picture has changed much in recent years. For many faculty, things are the way they are today because that is the way they have always been; further, most faculty find the majority of traditional teaching practices more comfortable than not. [14]

C. The self-definition of roles: Expectations about faculty members' roles and responsibilities are often categorized under three areas: *teaching*, *research*, and *service*. Though institutional settings, climates, and prevailing practices naturally tend to vary, currently on many campuses considerable tension exists with regard to the relative importance that should be placed on each. "The language of the academy is revealing: professors speak of teaching *loads* and research *opportunities*, never the reverse" [14].The greatest paradox of academic work today is that most of the faculty teach most of the time, but, unfortunately teaching is not the activity most rewarded by the academic profession nor most valued by the system at large [36].Irrespective of the relative value campuses place on the three categories noted above, these categories provide faculty members with the universally recognized cornerstones for personal self-definition; and the same three create inherently conflicting pressures for faculty members' attention, time, and energy. To the extent that campuses provide greater recognition and rewards for research and research grants over teaching, the likelihood of faculty members' seriously and significantly making

efforts to improve instruction is reduced. Administrators – at department/college/ or institutional level - have always praised good teaching but rewarded research! Even professors themselves do the one (*teaching*) but acclaim the other (*research*).

D. The lack of incentives to change: Faculty members see few incentives to change for several common reasons. ***First and foremost***, is the pervasive belief that "we are all reasonably good teachers?" ***Second***, there is a very limited financial incentive, if any, to devote the time and effort acquiring alternatives to traditional approaches of classroom teaching. ***Third***, the perception shared by most faculty that time and effort spent pursuing research and research money, is more rewarding, from an institution point of view, than time spent improving one's teaching skills. ***Further,*** the personal costs of trying new innovations are often high, and innovations are acts of faith requiring that one believe that they will ultimately bear fruit and be worth the personal investment, often without the hope of immediate return. Given that most faculty view themselves as above average, and that change can involve high personal costs, faculty members who attempt alternatives to traditional approaches are relatively few. Therefore, little reason exists to try new approaches, particularly when one's self-perception includes the image of being an above average teacher.

Looking Forward?

A root question, what is an engineering education for? – should be on the table for an evolutionary debate, referring, in particular, to the future of engineering education. What engineering students need to learn, and ***how*** can they best learn it, as well as ***how*** can engineering schools best teach it? are among the "questions" to be considered. The **"How"** is at the crux of the matter. Changing the *status quo* is never easy, but time has come for Region's colleges to turn a "new leaf" and begin moving in the direction of *active learning strategies*, in general, and *cooperative learning* environment in particular.

The author is convinced that unless, and until, the institution requires it, i.e., makes it "mandatory", academics will continue to pursue their present course. While paying lip service to "teaching excellence," most institutions of the Region do not provide clear and visible support and/or rewards for innovative teaching. Therefore, institutions have implicitly endorsed the *status quo* of "traditional" classroom instruction. The author believes that in addition to mandating the "change", an effort should be made to create a climate for improvement in classroom instruction by changing the social and cultural norms that have prevailed for decades. Such an effort should permeate throughout the academic arena, re-defining the role of teaching faculty, underscoring the fact that learning is a consequence of students' engagement with the subject matter, and emphasizing that the simultaneous presence of interdependence and accountability are essential to learning. The specifics of such an effort ought to include the following:
i) Rid classroom teaching environment from prevailing passive approaches to learning, and plant the seeds for active learning protocols throughout the public education system. Propagate the idea that: student-teacher interactions are a "priori" to stimulate learning for all parties at all levels.
ii) Provide the manpower and support necessary to "in-house" education units and/or centers that define, promote, and encourage the art of appropriate teaching, including active learning

protocols. Scholarly research about teaching, in general, should be encouraged, valued, and discussed.

iii) *Provide instructors with clear and consistent communications about expectations regarding teaching*. Faculty become frustrated and confused when told that teaching plays a vital institutional role, but to find out that rewards are for research. Effective teaching should also be rewarded, and poor teaching needs to be remediated through training and development programs.

iv) Encourage instructors, when using alternative instructional strategies, to meet the specific needs of students' different learning styles. Students are inherently different, and so are their learning styles. [37]

v) Target new instructors, in particular, and help them to make the transition from traditional methods to active learning strategies. Young faculty must feel that it is all right to try a new strategy, even if the first trial is less than satisfactory.

Some institutions in the Region have lately attempted to meet some of the noted objectives by relying exclusively on teaching awards. This modest approach has not worked! Broader, more effective initiatives appear to be needed to infuse a commitment to proper teaching and *active learning strategies* throughout the Region. The real key to establishing and nurturing a supportive environment for innovative teaching, is to create a university-wide administrative structure that takes it upon itself to promote, reward, monitor, and publicize excellence in the classroom. If and when such a structure is established, its prime mission would be to approach the different colleges, departments, and groups within the university hierarchy, seeking ideas, plans, scenarios, to translate the "mandated" change into reality. Common questions that are likely to come up include: How to get started? What are the initial steps that should be taken to move forward and begin the process of change? Who should initiate the process? What guarantees its success?

Invariably, different scenarios may be arrived at, and faculty members who have had some prior experience, and/or have the self-confidence in deploying *engagement practices* should be given the opportunity to lead in this effort. However, leaving change up to individual faculty members without a supportive culture that values effective teaching/learning pedagogies for classroom reformation and educational development, doesn't work. Piecemeal efforts- an initiative here or a success story there - could result in pockets of improvements but will not change the *status quo* within the Region as a whole. What is necessary, from author's perspective, to plant the seeds and sustain the "change", is for the university (i.e., the department, the college, the group) to arrive at a comprehensive and integrated set of components: clearly articulated expectations, a reward system aligned with these expectations, and opportunities for faculty to acquire new pedagogies.

Concluding Remarks

To keep pace with fast changing global marketplace, engineering education in the Arab Gulf States (Saudi Arabia, Kuwait, Bahrain, Qatar, The United Arab Emirates, and Oman) has to undergo major "reformation" including revitalization of the classroom environment. There is concern among students, faculty, and graduates of the Region's institutions- *arrived at through a survey targeting new engineering graduates & the feedback from Region's faculty interviewed recently* - that current teaching practices (traditional teaching) appear to have adversely affected

outcome. There is an urgent need to adopt new and innovative approaches in teaching. *Active learning* has lately attracted advocates among engineering faculty in the Arab Gulf States searching for alternatives to traditional methods.

The paper reviews the *pros and cons* of the traditional lecture approach, defines the common forms of *active learning* most relevant for engineering faculty in the Region, and argues that the introduction of classroom-based pedagogies of engagement such as *cooperative learning* can help break the traditional lecture–dominant pattern. To maximize students' achievement, especially when the subject is complex, instructors should not allow students to remain passive while they are presumably learning. One way to get the students actively involved is to adopt a *cooperative learning strategy*: getting them to teach one another, dig below superficial levels, learn "to learn" and not just to pass the test, get to know their classmates, and build a sense of community with them. It is important that when seniors graduate they have acquired the social skills required to work cooperatively with others and are able to balance personal relations and be contributing members of their communities.

This is a call for engineering faculty and program developers in the Region, to consider not only the content and topics that make up an engineering degree but also how students engage with these materials. It is also a call for the faculty of the Region to become aware and learn the new ways of teaching, and strive to develop and achieve a high level of pedagogical knowledge and competence. In the dialogue between administrators and faculty, needed to bring about the change, faculty will rightfully identify barriers including the time and resources needed to embark on the change. Also, they should request authorization to experiment with new ways of teaching without risking low teaching evaluations, and access to instructional consultants and experienced teachers to serve as mentors, when the need arises.

With regard to implementations, author's findings assert that classroom practices today have remained, by and large, very traditional. And none of the novel approaches to teaching, including *pedagogies of engagement*, are deployed anywhere in the Gulf region. Therefore, unless the "change" is mandated by the institution, it is highly unlikely that the classroom environment would witness any noticeable shift toward *classroom engagement practices* any time soon. If and when the "change" is mandated, the challenge then will be: how to infuse the new pedagogies without causing disruptions or trigger some undesirable consequences? Said another way, is there an optimum balance between maintaining traditional lecture-based practices and the deployment, in part, of an *active learning pedagogy?* If so, what does the balance depend on? (Level of course? Type of course? Students' background? Instructor's abilities and skills?).

There are many questions that need to be addressed prior to institutionalizing pedagogies of engagement at the department or the college level. Implementation of said "change" may have to be carried out in phases and /or steps over time. It may take years before it reaches optimum condition. Changes will only be brought about through the determination of the leadership (deans, department heads, etc.), appropriate support and resources, and faculty members' willingness to learn and change their current classroom practices.

The myth expressed by some faculty that *"I am willing but they won't let me"* is a common response from faculty members to calls for reform in education. To the contrary, and as

eloquently expressed by Combs [38]: *"Teachers may not be able to change the educational system, or the administration, but the variations possible within an ordinary classroom are almost limitless."*

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