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ENHANCEMENT OF ENGINEERING EDUCATION IN THE ARAB GULF STATES THROUGH COOPERATIVE LEARNING PROTOCOLS

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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 Region's colleges, sheds light on the *pros and cons* of the *lecture format*, and examines the literature on substance of different *active learning* protocols, focusing on **cooperative engagement strategies**. Next, it identifies barriers to *reformation* in general, and to the use of modern pedagogical skills in particular. What is necessary to create a change, is for the department or college, to have a comprehensive and feasible set of plans: articulated expectations, opportunities for faculty to learn about new pedagogies, and an equitable reward system. The paper focuses on proper delivery of engineering courses, including **geotechnical engineering subjects.** Also, argues that institutional support is of paramount importance in moving the process forward.

INTRODUCTION

"To teach is to engage students in learning." This quote, from *Education for Judgment* by Christenson *et al* (1991), captures the meaning of the art and practice of pedagogies of engagement. The theme advocated here is that student's 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 what tools can be deployed to stimulate learning.

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 to all other group members (Bonwell &Eison 1991; Fredrick 1987; Kolb 1984) .

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 reduce uncertainties about college attendance and increase integration into college life. Isolation and alienation, often, lead to failure. Two reasons for dropping out of college, are: failure to establish a social network of classmates, and failure to become academically involved in classes (Kolb 1984; Mckeachie *et al* 1986; Johnson *et al* 1991).

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 **engagement pedagogies** have not been effective in changing the "mind set" of most involved. Therefore, the traditional

mode of lecture where the information passes from instructor's notes to students' notes (without passing through the mind of either) continues as "the norm".

The paper renews the call for deployment of effective instructional strategies in the classrooms of the Region, 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: research support, current practices, and ways of redesigning classes to stimulate interaction to help break the lecture dominant pattern, by using *cooperative learning* protocols.

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 faculty who decide to use *cooperative learning*? Achieving the change needed across the Region requires collective effort by all involved, namely: the institution, the faculty, and the students.

AN OVERVIEW OF ENGINEERING EDUCATION IN THE REGION

Engineering education in the Arab Gulf States (the Region) 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 states of the Region(Bahrain, Kuwait, United Arab Emirates, Qatar, and the Sultanate of Oman), engineering colleges were founded soon after these states have gained their independence (Akili 2003; Akili 2008).

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, 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 many, recently established, private and semi private colleges and/or universities that offer engineering degrees.

These eight public colleges (shown in Table 1), have since their inception, been guided by advisory committees drawn from US colleges. Previously, the Grinter's Report (1955) and the Goals' Report (Walker et al 1968) have guided the educational process forward. Recently, ABET Engineering Criteria 2000 (*ABET* 2008) has been the subject of seminars and workshops, intended to assist colleges of the Region in making use of the EC2000, whenever possible. Indeed, the EC2000 has generated a lot of interest and challenges in the Region.

Admission policies, for all eight colleges, are based on grades obtained in an 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. 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):(i) math and science courses-to prepare for engineering "gateway" courses;(ii) hands-on "pre-college" training period; and,(iii) fostering a "proper learning environment", to help students acquire desirable attributes such as: analytical skills, creative thinking, and social skills (Akili 2003; Akili 2008)).

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

Country	COLLEGE OF ENGINEERING	Year Established
Saudi Arabia	King Saud Univ, Riyadh	Early sixties
Saudi Arabia	King Abdul-Aziz Univ, Jeddah	Early sixties
Saudi Arabia	King Fahd Univ of Petroleum and Minerals, Dhahran	Late sixties
Bahrain	University of Bahrain, Manama	Mid seventies
Kuwait	Kuwait Univ, Kuwait City	Mid seventies
Qatar	Univ of Qatar, Doha	Early eighties
United Arab Emirates	UAE Univ, Al-Ain	Early eighties
Oman	Sultan Qaboos Univ, Muscat	Mid eighties

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.

Majority of the respondents were between 25 to 30 years of age, citizens of the Arab Gulf States, and either employed or practicing engineering on their own.

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 by the respondents, on the need to replace *traditional teaching* that has persisted with better and more effective methods of course delivery (Akili 2008). Some of the respondents have come to the realization, after having finished college, that learning is not an automatic consequence of pouring information into 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 promote and encourage faculty to adopt *"classroom–based pedagogies of engagement"*. This raises a general question: How can the Region, as one entity, promote systematic change to the education process, taking advantage of the wealth of available information on *teaching and learning*? There is no easy answer. But, developing a new cadre of faculty who are comfortable using novel *engagement strategies* would be a step in the right direction.

TEACHING AND LEARNING PRACTICES IN THE REGION: PRELIMINARY FINDINGS

To get first-hand information on teaching practices and classroom activities in the colleges of the Region, the author traveled - during the spring of 2008- 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, 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?* Have you kept up with recent developments in the arena of *pedagogies of engagement?*
- Are you willing to deploy any of those strategies (*pedagogies of engagement*) when the need arises?
- Preliminary information reveals that *engagement strategies* are not currently utilized in the Region, at any level, why not?
- Do you believe that *active learning* should be deployed in your department, and if so, what are the barriers?
- Based on your experience, what would you suggest to improve the classroom environment?

While answers to the above 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 interviewed faculty members asserts and/or amplifies the following points: *First,* nearly all 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. *Third,* 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. *Fourth,* some members have stressed that the success of any *active learning strategy* requires students' participation, raising the question whether students are ready and willing to become active participants in the process? *Fifth,* most members were mindful of the time and effort needed to become a more effective instructor; and concerned that teaching is 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 interviewed faculty) in the process by which the course content is delivered, 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 (Akili 2008) . 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 & CONS OF THE LECTURE FORMAT

Lectures have a number of characteristics that does make them, for the right subject matter, desirable in the classroom (Bonwell &Eison 1991; Vemir & Dickinson 1967; Lowman 1984). It depends 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;
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; and,
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; also, provide an advantage for those students who find learning by listening enjoyable (Vemir & Dickinson 1967). As most students will attest, not all lectures or lecturers achieve these goals. 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. Speaking extemporaneously is more effective than reading from lecture notes, and it is desirable to change the pitch, intensity, and the timbre of one's voice (Vemir & Dickinson 1967).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*. (Vernir & Dickinson 1967; Lowman 1984; Prince 2004).

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. Ten to 20 minutes into the lecture, confusion and boredom sets in and assimilation falls rapidly, remaining at a low state until a brief period toward the end of the session when students are revived by the knowledge that the lecture will soon be over (Penner 1984).

If a faculty member is hesitant about selecting one or more of *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 (Prince 2004; Smith *et al* 1981; Silberman 1996).

EXAMINING THE LITERATURE ON MEANINGS AND SUBSTANCE OF ACTIVE LEARNING

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. It is 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 (Randolf 2000).

Collaborative Learning refers to any and all of the instructional methods where students work together in small groups towards a common goal (Frederick 1987). It can be viewed as encompassing all group-based instructional methods, including *cooperative learning* (Mckeachie *et al* 1986; Lowman 1984). Some researchers view *collaborative and cooperative learning* as having two distinct historical developments and differing philosophical roots.

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 (1991).This model has five elements: mutual *interdependence*, individual *accountability*, face to face *interaction*, *interpersonal* and small group *skills*, and individual *assessment* of group *functioning*. Although different cooperative models exist, the core element in all is the emphasis on cooperative incentives rather than competition, in the promotion of learning.

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. 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, and substantiated with facts and figures. Despite some pitfalls, faculty should be encouraged to examine the literature on *active learning*, including the common barriers that may arise as a consequence of its application.

PROMOTING STUDENT ENGAGEMENT USING COOPERATIVE LEARNING STRUCTURE

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 (Prince 2004; Silberman 1996).

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 (Lowman 1984; Prince 2004):

- Positive Interdependence- Students should perceive the need for one another to complete 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 of 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.

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. The work by Johnson, Johnson, and Smith (1991) 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.

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 (Bonwell & Eison 1991). 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,

- 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, and
- Lack of needed resources to proceed with the new method, when applicable.

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 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", almost always, places "knowledge of the subject matter" well above all others.

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 very limited financial incentive, if any, to devote the effort and time needed to acquire alternatives to traditional approaches of 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.

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 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, 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 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, should be encouraged, and openly 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.

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

v) Target new instructors in particular, and help them to make the transition from traditional methods to active learning strategies.

Invariably, different scenarios may be arrived at, and faculty members who have had some prior experience 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 to plant the seeds and sustain the "change" is for the university (i.e., the department and the college) to arrive at a comprehensive and integrated set of plans: clearly articulated expectations and a reward system aligned with these expectations.

CONCLUSION

To keep pace with fast changing global marketplace, engineering education in the Arab Gulf States has to undergo major "reformation" including revitalization of the classroom environment. There is concern among students, faculty, and graduates of 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.

The paper reviews the *pros and cons* of the traditional lecture approach, defines common forms of *active learning* relevant for engineering faculty in the Region, and argues that the introduction of classroom-based pedagogies of engagement can help break the traditional lecture–dominant pattern. 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", get to know their classmates, and build a sense of community with them.

This is a call for Region's faculty to learn the new ways of teaching, and strive to reach a high level of pedagogical knowledge and competence. In the dialogue between administrators and faculty, needed to bring about the change, faculty members will rightfully identify barriers including the time and resources needed to embark on the change. Also, should request authorization to experiment with new ways of teaching without risking low teaching evaluations.

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, of an *active learning pedagogy?* If so, what does the balance depend on? (Type of course? Students' background? Instructor's skills?).

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. Change 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 (1997):*"Teachers may not be able to change the educational system, but the variations possible within the classroom are almost limitless."*

REFERENCES

ABET,[2008].<*http://www.abet.org*>,Accessed December 20, 2008.

Akili, W. [2003]. "On Reform of Engineering Education in the Arab Gulf States: A Focus on Pre- Engineering 'Prep-Program'", *Proc. The 2003 ACEE Annual Conf.,* (Session 2160), Nashville, Tennessee.

Akili, W. [2008]. "On Engineering Education in the Arab Gulf States: Students' Engagement through Cooperative Learning Strategies", Proc. *The 2008 ACEE Annual Conf.,* (Session 3660), Pittsburgh, Penna.
.

Bonwell, C.C., and J.A. Eison. [1991]. "Active Learning: Creating Excitement in the Classroom," *ASHE-ERIC Higher Education Report No.1*, George Washington University, Washington, DC.

Christensen, C.R., Garvin, D.A., and Sweet, A. [1991]. *Education for Judgment: The Artistry of Discussion Leadership,* Harvard Business School, Cambridge, Mass.

Combs, A.W. [1979]. "*Myths in Education: Beliefs That Hinder Progress and Their Alternatives*", Allyn & Bacon.. Boston, Mass.

Frederick, Peter J. [1987]. "Student Involvement: Active Learning in Large Classes", *In Teaching Large Classes Well*, edited by M.G.Weimer. New Directions for Teaching & Learning No.32, Jossey-Bass, San Francisco, Ca.

Grinter, L.E. [1955]. "Report on the Evaluation of Engineering Education (1952-1955)", Journal of Engineering Education, Vol.46, pp. 25-63.

Johnson, D.W., Johnson, R.T. and K.A. Smith [1991], "Cooperative Learning: Increasing College Faculty Instructional Productivity", *ASHE-ERIC Report on Higher Education,* the George Washington Univ. Washington, D.C.

Kolb, D.A. [1984]. "Experiential Learning: Experience as the Source of Learning and Development", *Prentice Hall,* Englewood Cliffs, CA.

Lowman, Joseph [1984]. "*Mastering the Technique of Teaching*", Jossey- Bass, San Francisco, Ca.

Mckeachie, W. J., P.R. Pintrich, Y.G. Lin, and David A.F. Smith [1986]. "Teaching and Learning in the College Classroom: A Review of the Research Literature", Ann Arbor: Regents of the Univ. of Michigan, Ann Arbor: ED 314999, MF-01; PC-05.

Penner, Jon, G. [1984]. "*Why Many College Teachers Cannot Lecture*", Charles C. Thomas, Springfield, Ill.

Prince, M. [2004]. "Does Active Learning Work? A Review of the Research", ASEE Journal of Engineering Education, Vol. 93, No.3, pp.223-231.

Randolph, GIBE. [2000]. "Collaborative Learning in the Classroom: Writing across the Curriculum Approach.", Journal of Engineering Education, Vol. 89, No.2, pp. 119-122.

Silberman, M. [1996]. *"Active Learning: 101 Strategies to Teach Any Subject"*, Temple University, Allyn and Bacon, Needahm Heights, Massachusetts.

Smith, K.A., Johnson, D.W., and Johnson, R.T. [1981]. "Structuring Learning Goals to Meet the Goals of Engineering Education" , Engineering Education, Vol.72, No.3, pp. 221-226.

Verner, C.and G. Dickinson, [1967]. "The Lecture: An Analysis and Review of Research", Adult Education, No. 17, pp. 85-100.

Walker, E.A, J.M.Petit, and G.A. Hawkins, [1968]. "Goals of Engineering Education", *American Society for Engineering Education,* Washington, DC.