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Case Histories in Geotechnical Engineering: Enhancing the Practice in an Interactive Learning Environment

Waddah Akili
Geotechnical Engineering, Ames, IA

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CASE HISTORIES IN GEOTECHNICAL ENGINEERING: ENHANCING THE PRACTICE IN AN INTERACTIVE LEARNING ENVIRONMENT

Waddah Akili
Professor of Civil Engineering (Retired)
Principal, Geotechnical Engineering
3222 Evergreen Rd., Ames, IA-USA 50014

ABSTRACT

This paper focuses on the utilization of ***case histories*** in supplementing classroom education, and describes the steps taken in planning, developing, and executing a case study/case history course in **geotechnical/foundation** engineering at an international university. The paper sheds light on: how a "workable" format for the course was arrived at; the organization of the course; and the results of evaluating the effectiveness of this approach versus traditional lecturing. Problems and challenges that could arise when offering the course for the first time are also addressed. Embedded in this experience and its related protocols are: the emphases on engineering design, the practice, teamwork, organizational management, and oral and written communication skills. The paper concludes by confirming confirms that discussions, through an open forum, are judged to be superior to traditional lectures in improving critical thinking, cultivating desirable personal attributes, and acquiring problem-solving skills including the ability to ask intelligent questions and participate in a useful technical discussion.

INTRODUCTION

Lecturing or "teaching by telling" is the traditional and the most widely used form of instruction in most engineering institutions. The major drawback of the lecture approach is that it usually results in long periods of uninterrupted instructor-centered, expository discourse, relegating students to the role of passive spectators(Johnson *et al* 1991).This method, however, continues to be the most dominant teaching method in engineering institutions and widely used in most classes.

To improve the relevancy of engineering education, we believe that teaching, or more fundamentally, student learning needs to be emphasized. *Learning*, as defined today, is more than the acquisition of knowledge. Bloom (1956) has defined six increasing levels of learning and/or comprehension, beginning with *fact-based knowledge*, and followed by: *comprehension* (using factual information and explaining facts), *application* (applying facts to solve problems, analyzing concept structures), *synthesis* (creating something new by using different components), and *evaluation* (exercising judgments and comparing new facts with existing knowledge). It is said that traditional teaching engages only the first level of learning as students down load information from a traditional lecture and upload it back on an examination and or a report. Not only does traditional teaching fail to take students through all six levels of learning, it also fails to engage students in the teaching-learning process.

In civil engineering education today, there is a growing need to replace traditional approaches of teaching by utilizing pedagogies of engagement (Smith 2005); and, simultaneously bringing practical problems and issues that practitioners usually face, into the classroom.(Akili 2005). Pedagogical studies have demonstrated that the *case study/ case history* approach to engineering education provides greater understanding of the multifaceted nature of civil engineering.(Chinowsky &Robinson 1997;Raju &Sankar1997). They can be used to simulate a variety of learning protocols such as: design and analysis experiences, interdisciplinary issues and concerns, costs, hazards, owner preferences, and compliance with standards and guidelines. *Cases*, by and large, describe situations, projects, problems, decisions, etc., and are primarily derived from actual experience, and do reflect thoughts, outlook, and concerns of: managers, professionals, regulatory agencies, communities**,** and owners. *Cases* are also widely used in other disciplines such as: education, medicine, and law.

This paper describes the steps taken in planning, developing, and executing a *case study*/ *case history* course in geotechnical/ foundation engineering at an international university. The paper sheds light on: how a "workable" format for the course was arrived at; the organization of the course;

and the results of evaluating the effectiveness of this approach versus traditional lecturing. Problems and challenges that could arise when offering the course for the first time are also addressed. Embedded in this experience and its related protocols are the emphases on engineering design and the practice, teamwork and leadership development, organizational management, and oral and written communication skills. The paper concludes by confirming that discussions, through an open forum, are judged to be superior to traditional lectures in improving critical thinking, cultivating desirable personal attributes, and acquiring problem-solving skills.

WHAT IS A CASE STUDY?

A *case study* typically is a record or a narrative account of a technical and a business issue (problem) that actually has been faced by an individual and/or a group, together with relevant facts, opinions, and prejudices upon which decisions have to depend. Several case formats appear in the literature. Most cases are intended to engage students in a in a learning process through: analysis, open discussion, and ending with evaluations and recommendations. A *case history* describes how a problem was approached and solved, and often examines the consequences of the decisions made. A *case problem* remains open ended - leaving the analysis and choice of a solution up to the students. A *case study* often includes an "ideal" or "benchmark" solution; also, identifies or illustrate best practice. The main purpose of a *case study* is to illustrate a principle and/or the value of a specific approach or method. Where as a *case method* refers to a particular strategy for using cases in the classroom, to structure an active learning process of self-discovery(Richards *et al* 1995).

Shapiro (1984) presents several approaches to developing knowledge and skills. *Lectures and readings* are appropriate for "acquiring knowledge and becoming informed about techniques", *exercises and problem sets* are "the initial tools for exploring the applications and limitations of techniques," but the development of philosophies, methodologies, and skills is best served by the *case method*. *Cases* are used to extend the learning experience beyond the classroom exercises and laboratory experiments. Shapiro states that "the case method is built around the concepts of metaphors and simulation." Each case is a metaphor for a selected set of problems or issues. In their analysis and discussions, students are expected to simulate the information processing and decision-making skills of managers or engineers involved in the case. *Cases* require students to consider multiple factors and to integrate information from various sources. Thus, *cases*, in various forms, are one solution to the widening discrepancy between traditional classroom teaching and what really takes place in the real world. They give students experience with situations and challenges they do not usually come across during traditional classroom activities. In any of their form, thoughtfully planned and well prepared cases provide:

- ***Relevance***. *Cases* depict real situations at a particular location and point in time. As such, they tend to provide an insight into the decision-making process. Students see the relevance of the case to their future careers.
- ***Motivation***. *Cases* can provide incentives for students to immerse themselves in real engineering tasks. Also, assuming the role of a practicing engineer can be challenging and stimulating.
- ***Interaction***. Students learn more when they participate and become involved in the case– its history, background, discussion, and resolution.
- ***Integration***. *Cases* require students to draw upon knowledge from different sources and to integrate concepts, techniques and tools from previous courses.
- ***Communication***. Review of a reported case, along with relevant documents, memorandums, literature, etc., plus the need to relate information to other participants (instructor, students, practitioners, etc), necessitate use of appropriate language and presentation methods. This aspect of case handling would invariably improve students' communication skills and help in building self-confidence.

Finally, one of the fundamental principles underlying the *case study* approach is: the nontraditional role of the instructor, whose role is not so much to teach students as to encourage learning. His/her role is more of a facilitator and he/she has to be both a teacher and a practitioner.

THE SPECIFICS OF THE EXPERIENCE

At an international university, the author introduced a *case study/ case history* course in the area of geotechnical /foundation engineering to Civil Engineering seniors, to achieve better learning outcomes through class participation, foster a deeper approach to learning, broaden students' perspectives, and emphasize foundation design issues and problems visa a vie the Region in general and the locale in particular. At the same time, bring the practice into the classroom, and stress on the imperative of superior communication skills and life-long learning in professional practice. The author has always been of the opinion that students, as emerging professionals, should have a venue on the *local practice*, preferably in a nontraditional setting, with emphasis on interdisciplinary problems. Also, adopting instructional practices that engage students in the learning process is one of the defining features of the course. The importance of student engagement is widely accepted and there is considerable evidence to support the effectiveness of student engagement on a broad range of learning outcomes (Price 2004; Smith et al 2005). Specifically, students should learn as early as possible to work with others, to coordinate multifaceted problems, and search for information on their own.

After decades of increased emphasis on engineering science, engineering undergraduate education has become largely dissociated from the practice of engineering. The emphasis on analysis had outpaced the incorporation of synthesis and design as well as a number of broader educational and intellectual imperatives that were becoming increasingly evident. Concurrent with the building of the analysis emphasis over the decades, the undergraduate educational experience became increasingly fragmented into what appeared to students as independent parts. Their have also been strong pressures to add new technical subject matter as well as pressures and national agendas which have increasingly been calling for more rounded engineering graduates with the ability to function in a socially interactive , communicative, and business climate of modern industry. Satisfying such a broad set of demands within the traditional program structure seems extremely difficult. Indeed, a significant culture change should take place in engineering education. The challenge is clear, but the path forward is not well defined.

Lately, the author came to the realization that a case study course-if properly planned and executed- would raise students' awareness of the practice, exposes students to decision-making, train students to think "holistically," and provides an opportunity for teamwork and leadership development. After getting the approval, efforts were directed towards: sketching out the general framework, searching for the proper materials, and outlining the process of execution. The decision was made, early on, that the intended course should focus primarily on geotechnical issues and problems of the Region. Therefore the selected cases, and relevant presentations' materials, would have to be from the Region, reflecting Region's issues and concerns. Initial search for relevant publications, that would fit the description of documented case histories from the Region, were very scanty. Therefore, other sources would have to be resorted to in order to compile the desired number and type of documentation for the intended exercise.

Documentation

A formal call was sent out to almost all geotechnical/ foundation consulting offices that have operated in the Region, requesting documented cases in the form of engineering reports. Within three to four weeks from the date of request, nearly one hundred geotechnical reports were received. A thorough selection process, based on: scope, relevance, technical content, and lessons learned, brought the number of *usable* reports down to twenty. Further sorting and evaluation, reduced the number down to fourteen *case histories*, believed to reflect accurately the design and construction issues, and concerns that beset geotechnical engineers in the Region. Each case was subjected to analysis and scrutiny, and supplemented with background information to reduce ambiguities and uncertainties, and help guide students through the learning process. Selected cases addressed a wide range of multifaceted real-world projects, categorized, totally or principally as: geotechnical/ foundation engineering. Major headings and /or titles of majority of the selected cases have included: i) *analysis and design of foundations for a housing complex*; ii) *slope stabilization of a major highway*; iii) *geotechnical investigation and foundation design for a high rise building ; iv) analysis and design of an offshore loading facility*; v) *site investigation, analysis and foundation design of large storage tanks; vi) investigation, design, and performance of a stone column foundation; vii) design and construction of shallow foundations over salt-laden cemented sands; viii)instrumentation, monitoring ,and analysis of an embankment slide; ix)load tests on drilled shafts for highway bridges; x)ground modification by dynamic compaction for a shopping mall; and, xi)shallow foundation on a diagenetic limestone formation in Qatar.*

Each case was reformatted and subsequently arranged according to a preset outline to ensure that each *emphasis* area is properly covered. The emphasized areas included:

1) Site-specific soil and rock data;
2) Analysis and design of the foundation;
3) Recommendations, safeguards and alternatives;
4) Post construction monitoring; and ,
5) Non technical factors that have influenced decision making and final recommendations. The final document comprised of: the fourteen "reformatted" cases plus instructor's perspective of the nontraditional approach of delivery planned for the course, were made available to interested students well ahead of the start of the semester. Therefore, interested students had ample time to review content, ask questions, suggest changes if needed, and develop their own impression of what the course would entail, should they decide to register. In general, developing the documentation was hard work, time consuming, and required a great deal of diligence and care. In most institutions the development of instructional materials is typically not rewarded through promotion, tenure or pay. However, the author has the conviction that the big reward is in seeding the process of vibrancy and innovation in undergraduate engineering, for which the faculty should take a leadership responsibility.

Teacher's Role

Faculty members who decide to use *cases* effectively in teaching must *rethink* their role in the classroom and change their behavior in significant ways. In this case, the instructor has to think of himself/herself as a manager, a facilitator, a planner, a care taker, or possibly a leader of the group. In his/ her capacity as a planner and a facilitator, the instructor has to articulate the key components and associated instructional strategies. Invariably, this would require expertise in the subject matter, as well as, conviction, knowledge, and experience in nontraditional ways of teaching and learning. There are general steps considered by the author as helpful in achieving success. These steps include: i) articulation of key topics of the course and arrival at optimum methods of delivery; ii) attempt to uncover- as much as possible and prior to the start of the course- the different learning styles, dominant thinking processes, and other learning characteristics of incoming students, through suitable questionnaires complimented with interviews; iii) designing and/ or selecting learning experiences/ activities and instructional tools that are compatible with students' thinking processes and learning styles; and finally, iv) insuring that the selected tools and the designed learning environment, foster autonomous learning.

Assessing "what works" requires looking at a broad range of learning outcomes, interpreting results carefully, quantifying the magnitude of any reported improvement and having some idea of what constitutes a "significant" improvement. This last will always be a matter of interpretation, although it is helpful to look at both statistical measures such as effect sizes and absolute values for reported learning gains. (Price 2004) No matter how results are presented in the literature, faculty adopting instructional practices with the expectation of experiencing results similar to those reported should be aware of the practical limitations of educational studies. In general., educational studies tell us what worked, on average, for the populations examined and learning theories suggest why this might be so. However, claiming that faculty who adopt a specific method will experience similar results in their own classrooms is simply not possible. Even if faculty master the new instructional method, they can not control all other variables that affect learning. There are conditions where a teacher may have to "go with the odds." The more extensive the results supporting a new method, and the more the instructor's students resemble the reported test population, the better the odds are that the method will work for a given instructor. Notwithstanding the problems that could arise, engineering faculty should be encouraged to examine the literature on novel methods of teaching. Some of the evidence for active learning is compelling and should stimulate faculty who use traditional methods to think about adopting teaching and learning in nontraditional ways.

The instructor, based on his own experience, has come to the conclusion that *collaborative learning* is a viable alternative and would be a good choice to promote a broad range of learning outcomes. In particular, collaboration enhances academic achievement, student attitudes, and student retention. *Collaborative learning* can be defined as any instructional method in which students work together in small groups towards a common goal (Price 2004). As such, *collaborative learning* is viewed by many as encompassing all group-based instructional methods.(3) The core element of *collaborative learning* is the emphasis on students' interactions rather than on learning as a solitary activity. A related question of practical interest is whether the benefits of group work improve with frequency. Springer *et al* (1999) looked at the effect of incorporating small, medium and large amounts of group work on achievement and student attitudes. They found that medium time in groups is the best for achievement, and high amount of time in groups produced the highest effect on students' attitudes.

<u>General plan</u>

Despite some hesitation at the beginning, the instructor took the first step and made the decision to let *collaborative learning* be the prime instructional method for the *case study/ case history* course he was in charge of. The course attracted twenty one seniors, who successfully had passed, two prerequisites: geotechnical engineering I, and foundation engineering. A total of seven groups - three members per group- were formed. At the outset, it was understood that group mates have to work together, help each other, trust one another, and arrive at a general consensus within the group on subject matter analyzed and/ or discussed in class. A group recorder- agreed upon by group members- was assigned the responsibility for providing the views of the group and feedback during discussions. He/ she also reported to the instructor on all matters that the group wished to relate. The following points helped to improve the quality of group work: instructions passed on to groups were explicit; guidelines regarding responsibilities of a member within a group, as well as relations between groups were sketched out; and an appropriate time frame for all activities was arrived at and communicated. Each group was assigned two case histories out of a total of fourteen pre-selected cases as explained earlier. This meant that each of the seven groups would take charge of two cases in terms of: presentation, provision of additional supplementary information when needed, and documenting generated discussion that proceeded presentation. The three 50 minute sessions per week were apportioned as follows: The *first session* was primarily devoted to the presentation of the selected case by the assigned group, followed by a short question and answer period. During the *second session*, an open discussion, guided by the instructor, would be geared towards relevant technical and nontechnical issues that had a bearing on the case. In this *second session*, all seven groups that made up the class contributed to the discussion. In the *third session*, an invited speaker, a practitioner, would address the class, focusing on real issues and concerns that only practitioners could address. During the final fifteen minutes of the *third session*, the instructor would summarize the case pointing in the direction of: lesson(s) learned, discrepancies, if any, and how the presented case would relate to and/ or supplement the knowledge students have been exposed to in previous courses.

Getting off to a good start is vital, so the first class session was an ideal opportunity to be clear about expectations and to impress on the students that the success of the course depends on the contribution of every student in the class! It was an appropriate time for the instructor to share his expectations for the course, describe the overall goals, and explain the relevancy of the course to the students' program in general. Also, the instructor stressed on how case histories can enrich the practice, and how to judge data derived from case histories. During the first session the instructor briefed the students about his teaching philosophy in general and discussed the benefits of using *collaborative learning*. Students were also invited, during the first week, to an icebreaker: to break barriers, foster a sense of community, and create a climate where students begin to feel that the instructor is some one they could approach. The *rapport* that was initiated early on in the semester was sustained through out the semester. To facilitate this *rapport*, the instructor was available to students during office hours, or by appointment. He also stressed on the need, for each group, to get to know each other, open up to one another, and seek each others help and advice in all matters relevant to the course. The instructor found out, soon after the course had started, that some students needed help beyond the scheduled classroom activities. Specifically, students, who had limited exposure to the ways and means of putting on a presentation, needed advice on how to prepare for their assigned case history presentation. Assistance was also provided in the following areas: clarifying some principles and in bridging the gap between prior knowledge and new course material; shedding light on tools, tests, and devices used in the field; and, in interpreting field data and arrival at final design recommendations.

Difficulties That Have Arisen

Some of the challenges that have characterized the experience, and worthy of mentioning, were: i) *English language-related issues:* English was a second language to all students in the course. Therefore, instructor' understanding, patience, and support in overcoming students' deficiencies in oral and written English, was required and appreciated by all. ii) *Lack of courage to express one's self***:** Despite the fact that students wanted to be active learners, and to express their view in the open; many could not say what they wanted. They simply did not have the courage and self confidence to stand up and make a statement in the presence of their classmates. This is attributed, in large measure, to the traditional education system that has prevailed for years, relegating students to the role of passive spectators.iii) *Lack the drive and desire to learn on their own:* Most students were not used to do their own search or attempt to learn on their own. They are accustomed to being told what to do. And if they do what they were told to do they will get the grade they deserve. Students are thoroughly deficient when it comes to thinking critically about problems other than those they have been tutored to respond to. iv) *Difficulties in seeing the big picture:* Many have difficulties seeing the "big picture". They have poor perception of the "holistic view". The engineering educational experience today has become increasingly fragmented into what appeared to the students as independent parts. v) *Shallow approaches to learning:* Most students have become used to shallow approaches to learning, apparently fueled by a high workload and fear of failure. In the shallow approaches to learning, the student focuses on learning isolated tasks often through memorization. The student's goal is to be able to reproduce the information; the student does not focus on understanding or determining meaning but instead on superficial form.

The above noted challenges were frustrating to the instructor and difficult to overcome. The instructor, through the well-planned course activities and by using *collaborative learning*, tried to help the students in overcoming some of these "deeply rooted" undesirable personal traits; and believes that he has partially succeeded. Also, mounting pressures, to add new technical subjects coupled with ineffective teaching methods exacerbated further against student time for independent thought, development of desirable personal traits, and the personal satisfaction and joy of learning.

Improvements and Challenges in Learning Outcomes

Despite the noted deficiencies, brought about by the prevailing traditional approaches in the transmission of knowledge, the author believes that improvements in learning outcomes were achieved. The moderate success of this experience is largely attributed to the assertion of the instructor that a positive classroom environment should prevail despite some setbacks and resistance on the part of some students. The specifics of this positive environment were manifested by:

- *Higher level of student participation*: student-student dialogue and interaction, and building a sense of community with one another.
- *Nontraditional classroom environment*: where questions and answers, open discussion, and general consensus, replaced, to a large extent, the traditional lecture format.
- *The perspectives of geotechnical professionals*: the presentations, comments, and evaluations made by invited practitioners from the locale, helped enrich and enliven the experience, by focusing on real issues and concerns that only practitioners could address!
- *Instance on a holistic approach*: the multiple factors involved in all or some of the cases, including: financial, climatic, available resources, and managerial issues, helped students develop an understanding of the case(s) from a holistic point of view and not from an engineering perspective only.

Also, the positive interpersonal relationships, promoted by cooperation amongst individuals within a group, as well as inter-group cooperation, has helped boost self-esteem and made some students more socially skilled than before. Many students did come forward and acknowledged that they gained in terms of: improving their technical know how of Region's soils and geology, linking theory to practice, exercising engineering judgment, decision making, and becoming more acquainted with presentation and communication skills. Table 1 shows the technical areas that were focused on during the course, and around which in-class discussion was generated. The author believes that the components described in Table 1, brought out during presentations and follow up discussions, helped in shedding light and in answering questions that did arise during course proceedings.

The instructor, during the entire semester, was trying to stress that the information should not only pass from the instructor to the students, but also from the students to the instructor and among the students. He was always emphasizing that interdependence is essential to learning, and it is at the heart of a student-engaged instructional approach.

Table 1. Major Components of Relevant Technical Subjects That Were Focused on.

No.	Subject Area	Specifics
I	**Properties and characteristics of local soils**	• An overview of Region's dominant soils and its surface geology. • Developing better understanding of controlling processes in: collapsing soils, expansive soils, cemented soils, and saline soils. • Exposure to soil investigation techniques including in situ testing. • Exposure to post construction monitoring with particular reference to compressibility of clay layers.
II	**Data reduction and analysis**	• Review of data reduction methods. • How probability theory could be applied to raw data. • Gaining understanding of how field and lab data could be analyzed to generate design parameters.
III	**Design considerations, appropriate formulae, and methods**	• Dwelling on allowable bearing capacity and tolerable settlements, with particular reference to locally deployed methods and formulae. • Address stress increases in soil mass due to foundation loads. • Review elements of foundation design in soils susceptible to wetting. • Review of load transfer mechanisms in piles and drilled shafts visa vie local experience. • Calculation methods and determinants of sheet pile wall design and braced cuts.
IV	**Ground modification**	• A review of: vibroflotation, dynamic compaction, stone columns, & sand drains.

The instructor, in his desire to bring about a change in students' attitudes towards learning in general, and, at the same time, maximize their benefits and enhance their involvement with the case history course, in particular; exercised extreme care in teaching. He taught about connectedness, objectivity, competence in decision making, and the need to consider non-technical issues such as: the environment, community development, and socio-economic factors. Care in teaching requires attentiveness to the students, and hence to the diversity- in background preparation, learning styles, and in interests related to the course. Therefore, ideally one should know the students before planning the course. However, the course and its planning came first chronologically. Care, as understood by the instructor, means that one should plan the course with all the competence in the subject area, with the most appropriate pedagogical method, and with built-in flexibility. Unfortunately, there were elements that were beyond the control of the instructor, such as: students' background, classroom physical setting, and program's rigidity.

An extremely useful way to consider student learning is to look at deep versus shallow approaches to learning (McLeod 1996; Wankat 1999). Our current understanding of the difference between the two approaches stems from a research done in Sweden that relates deep approaches to learning to biochemical changes in the brain and may lead to long term changes in cognition, attitude and character structure.(Entwistle 1987; Ramsden 1992) In shallow approaches to learning, students learn by memorizing; they do not focus on understanding, or dig deep into meaning but instead on superficial form. In a deep approach to learning students focus on determining the meaning of what they are learning and on learning and on learning the connections and patterns which make learning holistic. Students, by and large, have the capability to develop and use either approach to learning. Deep approach requires more effort, more time, and more concentration than shallow approach. Students who are used to shallow approach to learning may find a deep approach difficult. The instructor was convinced that the majority of students in the class were users of shallow approaches to learning. He felt the urge to make them consider using the deep approach instead. He continuously reminded the students "to think" before making a statement or writing down an answer. Some of the slogans and general statements the instructor repeated, time and time again, during the semester are listed in Table 2.

To the surprise and dismay of some students, this course was not the "plug-and-chug" type where students insert numbers into the "right" equation, and get results; and accordingly get enough credit to pass even if they do not understand the problem. Instead, the course relied on developing the thought process and was aimed at developing students' ability in processing and digesting new information; synthesizing and integrating said information; modeling and/ or depicting field conditions, and arriving at appropriate conclusions and/ or recommendations

SUMMARY AND CONCLUDING REMARKS

The goal of the *case study/ case history* course described herein was to improve the relevancy of civil engineering education in the arena of geotechnology. Cases are normally used to extend the learning experience beyond the traditional classroom activities. Cases are optimum when they relate real-world issues and expose students to analysis and decisions encountered by practicing engineers. A *case study/ case history* course is one solution to the existing discrepancy between what is taught at the university and what actually takes place in the field. The case approach to learning requires more of the student than merely assimilating information. Passive listening is not sufficient. The student must be an active participant, and assumes roles that he/ she may have not experienced before such as: presenting information, participating in open discussions, and most importantly being an active member of a group.

Table 2. Slogans Used to Remind Students of Commitment They Needed to Make to Maintain Good Standing and Maximize Their Benefits from the Course.

- **Have an open mind! And try to think outside "the box"!**
- **Be inquisitive, do not be shy to ask, and think before asking!**
- **Scrutinize documented material, and do your own search!**
- **Searching, at times, is demanding and can be exhaustive!**
- **Air out your views and thoughts before reaching a conclusion.**
- **Open up to your group mates and do not isolate yourself!**
- **Be positive in your attitude towards your group mates. Help, encourage, and support each other's efforts to learn.**
- **Abandon the precept of "competition" and replace with the spirit of "cooperation."**
- **Learning is not memorizing. Learning is understanding and retaining knowledge.**
- **You are not in this course (*case history in geotechnical engineering)* solely to fulfill a requirement to graduate. You are in the course to acquire knowledge that has enduring value beyond the classroom**

The paper describes the steps taken in planning, developing, and executing a *case study*/ *case history* course in geotechnical/ foundation engineering at an international university. The paper sheds light on how a "workable" format for the course was arrived at; discusses the organization of the course; reveals some of the problems that have arisen; and focuses on improvements and challenges in learning outcomes. Embedded in this experience and its related protocols are the emphases on: (i) how geotechnical engineering is practiced in the Region; (ii) pedagogies of engagement and *collaborative learning* in particular; and (iii) development of more effective communication skills including oral, written and other delivery methods.

Perhaps the greatest challenge in this exercise was the attempt to create an *active class environment* and break away from the traditional method of "teaching by telling" that has gripped the education system for a long time, with little opportunity, if any, for questions and answers and/ or a feedback loop. Despite some inherent deficiencies, attributed principally to the rigidity of the education system in place, most students have expressed their approval and satisfaction of being in a *collaborative learning* environment. The most frustrating part of teaching this course was the extreme difficulty in getting some students to participate and become team players, and/ or to have the courage to ask questions. The most rewarding part was the opportunity to work with many students who clearly grew during the course, broadened their perspective about the geotechnics of the Region, and acquired desirable traits including the ability to ask intelligent questions and participate in a useful technical discussion.

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