A Plan for Transforming Engineering Education at Texas A&M University

The TAMU Dwight Look College of Engineering (COE) released its Strategic Plan (SP) for 2011-2015 (attachment from http://engineering.tamu.edu). The plan identifies key issues and sets forth actionable goals, strategies and indicators for five key areas. One key area is undergraduate education. The plan stresses that “meeting the commitment to the State of Texas demands more than just preparing problem solvers that will enhance the economic development of the State.”

The Plan reflects on the global landscape and dramatic pace of change in science and technology, recognizes the attributes for modern engineering education and practice, and provides a transformative roadmap to educate young engineers on a foundation of experiential learning, drawing on solid research findings and best professional practices.

The COE, having an overarching commitment to the culture of excellence (http://vision2020.tamu.edu/the-twelve-imperatives), has as its main goal to transform TAMU into the “institution of choice” for innovations and breakthroughs for the engineering challenges of the 21st century (http://www.engineeringchallenges.org).

Read (individually) and as a group discuss the attached COE SP. In particular, read critically the Overview (p. 9) and the Plan for Focus Area 1: UG Academic Experience (pp. 10-14). You, as a student, have both a responsibility and a stake to evaluate the SP goals, strategies (how to implement goals), and indicators (how to measure their attainment).

As a group, evaluate Goal 1.1, and prepare a (no less than) 400 word (longer OK) essay addressing to the following questions:

a) Why is a transformation in UG engineering education needed? Why now?

b) Why does the TAMU-COE want to become an institution of choice?

c) What does it mean achieving experiential learning? How well has the TAMU UG education prepared you on this aspect?

d) What are the planned activities for students to gain critical thinking? How well the current UG education has prepared you on this aspect?

e) Why is engagement in “research” important in a transformative UG education?

f) Why is important to learn how to learn? And how to assess (measure) a commitment to lifelong learning?

g) Does the SP gives the means or specifies how (in terms of credit hours) the transformative education will take place?

As a corollary, how as a practicing engineer you will help TAMU, your alma mater, to educate effectively students (perhaps your own children) to meet contemporary challenges, be prepared for global competitiveness, create innovations and produce discoveries, etc.

Your lecturer; not just a teacher but also a former student, a parent and an employer, has particular interest in learning your informed opinion on how you evaluate your own education and that of generations to come.

The assignment intends to make you aware of institutional challenges and changes, and for you to participate in their implementation.

Thanks for your attention

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MEEN 489 Lecturer

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1 Strategic Plans are common to all organizations and institutions (families, corporations, universities, governments). SPs are important because they recognize shortages and/or opportunities; identify paths for future growth or just mere survival, outline strategies to achieve the transformative goals, and identify the means for their consecution. Successful SPs must involve all parties associated with the main purpose of the organization; for the COE: students, faculty, employers and the State.

2 I assume that, as a stakeholder of your education, you are fully aware of the COE SP. The Plan has been in preparation for several years. Student organizations (ASME Chapter for example) have played an important role in assisting to shape the SP.
Assignment 4: Strategic Positioning of the TAMU Engineering College

Our world is always getting smaller, not in terms of physical distance, but in terms of communication. A simple phone call can transfer an idea from one location to another on the opposite side of the globe and new ways are always being developed to improve this. It is for this reason that institutions, governments, and people are constantly adapting. For the Dwight Look College of Engineering, adapting to the accelerating pace of technological improvements is paramount to keeping an edge for its graduating engineers. The U.S. is beginning to lose its foothold in the modern engineering market and Texas A&M University believes it has the ability to help alleviate that problem.

Texas A&M University’s Look College of Engineering has set forth multiple goals to help boost its engineers and break into the top 10 institutions for engineering in the country by 2020. Texas A&M wants to become the institution of choice for those seeking an engineering education. By producing engineers that are able to identify future problems and provide solutions now instead of dealing with what is simply in the present, Texas A&M can become this choice institution and boost its reputation to see an influx of aspiring engineers. One way that this goal can be achieved is through experiential learning. The Look College of Engineering will adapt its current class curriculum to incorporate this ability to apply technical knowledge to real world applications having societal, global, entrepreneurial, and other impacts. Currently, classes at the college of engineering have performed moderately in preparing undergraduate engineers with this learning ability, only having a hand full of classes that focus on this task, but by laying a foundation throughout the curriculum with a “spine” of experiential learning, performance of graduate engineers can be greatly improved.

Proposed ideas to improve upon this involve instilling more critical thinking activities into the undergraduate students. Some of these activities include grant programs, mentorships, and more open-end questions in the classrooms. Critical thinking is necessary for successful engineers. Texas A&M currently emphasizes critical thinking throughout most of the engineering curriculum already, but more opportunities outside of classroom experiences are an excellent way to foster growth and continual learning for future engineers. Another way to help see growth in critical thinking is through undergraduate research. Research is an important component to an undergraduate education, especially if the student wishes to continue on into graduate school or a research career. In conducting undergraduate research, a student can acquire more in depth knowledge of their particular area of interest, have the chance to see how their technical knowledge gained in the classroom is applicable outside of the classroom, and prepare them for their future career.

All of this accumulates into the ability to form lifelong learning. By creating this “spine” of experiential learning, critical thinking, and incentives for research throughout the undergraduate curriculum, Texas A&M will be teaching its engineers to learn how to learn. Once an engineer graduates and leaves college, their education won’t simply stop. Since the technology of the world is improving constantly, the engineer’s knowledge needs to expand as well. By taking classes at a workplace, reading technology articles, and joining associations (i.e. ASHRAE), an engineer can keep the necessary edge to help their employers and their selves stay effective in this global market. Lack of lifelong learning is detrimental to the engineer’s profession. Many young engineers will come into college expecting that all they will ever need to know will be taught to them in their four year degree. Graduating or graduated engineers can take the time to give presentations to these entering engineers to impart their knowledge and experience and show that learning how to learn is important for continual lifelong learning. If Texas A&M’s Look College of Engineering is seeking to be in the top 10 colleges in the country by 2020, it can’t be done by the university alone and will need the help of its engineering graduates.
References:

Juzaitis, Ray (Chair), Strategic Plan 2011-2015: Strategic Objectives, Strategic Planning Committee, Fall 2010

Notes from reader
Opening paragraph is interesting but not clear, it needs more crafting for a stronger argument. The rest of the essay is well written and endorses the key points advanced in the COE. The essay gives an honest appraisal when noting that presently A&M COE has done a moderate job in preparing engineering graduates to face the realities and needs of a fast changing world. Just like the COE SP, there is no exploration of the means or time needed to enable the envisioned educational changes.
Thanks to the increases in technology and improvements in education abroad; industry within the U.S. is becoming a part of the global economy by transforming the skills needed by an engineer. “Turn-the-crank” skills such computer programming or drafting are now available around the world at a much lower cost than in the U.S. Innovation is one advantage American engineers have enjoyed, and this talent must be further cultivated to remain competitive in the new globalized arena. As a result, undergraduate engineering education must adapt to adequately prepare today’s engineers for the global environment rather than just the domestic one. American universities need to shift their focus to equip graduating engineers with a broader skillset including communication and cultural awareness training.

In lieu of this new environment, Texas A&M University (TAMU) has formulated a Strategic Plan (SP) to become an “institution of choice” to attract outstanding students and excellent professors and researchers [1]. By attracting such talent, the Dwight Look College of Engineering (COE) hopes to bring economical and intellectual benefits to the university, the state of Texas and the United States. In a world increasingly defined in terms of ideas, countries that can create new technologies will become the economic and industrial powerhouses of tomorrow.

To achieve this atmosphere, the COE aims to incorporate the idea of experiential learning into the degree plan. Experiential learning seeks to give students exposure to real world applications of knowledge and theory learned in the classroom through industry internships and co-op experiences as well as through classroom laboratory work. This concept has been well implemented in the undergraduate programs at TAMU, and almost every major class is supplemented by laboratory experiments which directly correlate to lecture material. In addition, the COE has also emphasized the importance of critical thinking in its Goal 1.1 in its SP by seeking to implement more open ended questions in course assignments to allow students to both define and solve a problem [1]. The current curriculum is designed to produce an acceptable level of critical thinking skills but these exercises are limited to mostly senior level classes.

Further focus on undergraduate research could help students to develop these skills outside of the classroom. While a broad overview of a subject matter is possible in a class lecture, the application of this knowledge in a research environment allows the individual to learn how to use their technical abilities to a real world problem.

With today’s technology and knowledge becoming outdated almost immediately, it is important to learn how to learn. While formal education ends at graduation, one must continue adapting to new concepts and technologies in order to remain competitive in the ever-
changing world in which we live today. To measure this commitment to lifelong learning, licensing boards require engineers to continue taking courses throughout their careers to stay abreast of new information. Additionally, individuals can set a standard or plan to constantly study and absorb technology as it becomes available.

To achieve these goals, the SP does not quantitatively describe the number of credit hours required to produce an innovative and adaptive engineer; it merely gives an outline as to how the curriculum will change in quality rather than quantity.

To aid TAMU in its future growth, **practicing TAMU engineers must give back in several ways.** First, return to campus to give presentations about how students can apply their knowledge and innovation at the workplace. Second, organize onsite tours to give the future engineers a feel for the work environment of today. Third, give financially to research or other programs that encourage the aforementioned critical thinking skills. Finally, **uphold the Aggie core values** in our own professions so as to reflect positively on the university as a whole and help the COE to further develop its reputation worldwide.

References


Notes from reader
Well crafted essay that endorses the key points advanced in the COE. Essay does not provide insight on how current students could benefit (or not) from the shift in education strategy. There is no exploration of the means (resources) or time needed to enable the envisioned education
Undergraduate Engineering and Vision 2020

Vision 2020 was originally set forth in the late 90’s as a way to enhance the reputation and culture at Texas A&M. The goal stated that A&M should be a top 10 public university by the year 2020 [2]. To do this, undergraduate programs must be modified in a way that leads us to meet this criterion. Undergraduate engineering programs need to be changed soon if Vision 2020 is going to be reached. Other schools around the world are surpassing Texas A&M in rankings based on engineering. The College of Engineering (COE) has declared that it wants to “transform Texas A&M University into the “institution of choice” for those striving for innovations and breakthroughs that address the engineering challenges of the 21st Century” [1]. COE declares that problem solvers are not good enough. The COE wishes to educate engineers capable of innovation, application, and the creation of solutions to problems that push new limits of technology. By becoming an “Institution of Choice” Texas A&M will attract potential students with higher motives that will work to create these breakthroughs during their undergrad education.

To create an environment for breakthroughs and increase in technological developments, experiential learning is key. Experiential learning includes a hands-on learning environment in which students are able to apply theories in engineering subjects, create working models, and experiment to see how their theories hold up. This, in my opinion is where Texas A&M Engineering struggles the most. Engineers at A&M are not taught basic manufacturing and troubleshooting skills of mechanical systems. Very few classes do we engage in the manufacturing and hands-on activities that are so crucial to learning. For example, thermodynamics of systems such as internal combustion engines and gas turbines are analyzed from a theoretical standpoint, but are never seen through a hands-on lesson. We are not taught to disassemble a car engine to find a solution to a given problem. Engineers are seen as the ones who can tear stuff apart, fix it, and put it back together. Many mechanical engineers coming out of A&M simply do not have these skills. The engineering technology department does a better job of teaching this than the college of engineering does. Those students take welding and manufacturing classes that show students the capabilities of equipment they are dealing with. In this sense, there is a certain disappointment in my engineering education. There is only a brief exposure to manufacturing processes in MEEN 360. Here we are introduced to welding, casting
and the use of lathes and mills to create a product. However this introduction is quite brief. There is also the opportunity for hands-on experience through senior design courses such as the Formula SAE team. These are great opportunities in which learning possibilities extend much further than a textbook. However, these opportunities are too few in relation to a four year engineering degree. The school should build upon these types of activities and create an environment in which students learn real life problem solving and teamwork.

The aspect of critical thinking is very important for engineers. Engineers must be able to solve open-ended problems that do not necessarily contain a UNIQUE answer. This is another weakness of Texas A&M Engineering. The process of soaking up information from lectures and spitting back at the professors has become standard throughout the duration of undergrad engineering. We are fortunate to have senior design courses in which critical thinking is developed, but the process of solving open-ended questions should be emphasized throughout the curriculum. A specific activity outlined in the plan for 2011-2015 states we will “Endow a student-supported and student-reviewed grant program supporting the development of hands-on courses” [1] provides hope for future engineers. By engaging the students in research and hands-on lessons, engineers will come out of A&M with a better sense of mechanical know-how.

Once engineering students graduate, the learning cannot stop. Any engineering field will be full of constant breakthroughs in technology. If we cannot stay with the industry and remain up-to-date, then our presence will become obsolete and we will no longer be of use to our company. In this way, Texas A&M has done a good job of student preparation. By fostering a team environment in our classes, we have become comfortable in working with a group and using each other to learn and progress. Collaborating is a vital part of continuing education.

The implementation of these ideas is going to be the true test. It sounds great to say we want to be better in these areas, but it is of no use if we cannot make it a reality. The plan states it wants to create classes for increased hands-on learning as well as mentorships with upper-classmen to develop these hands-on skills quickly. [1] The program is mentioned as remaining a four year degree, so credit hour changes will not be substantial. The help of engineering alumni will be required to help achieve the goals of the plan for the purpose of meeting Vision 2020. By staying involved with student-oriented projects after graduation, graduates can increase the level of Texas A&M Engineering. As an incentive, engineers can increase the level of worth of their
own diploma by increasing the ranking of Texas A&M Engineering. Projects such as the Formula SAE team and other senior design classes allow high levels of interaction with company representatives to increase the hands-on learning experience of senior level engineers. It is a great goal to attempt to achieve the school rankings we have put forth in Vision 2020, but by implementing these ideas we will be well on our way to becoming one of the top schools in not only engineering, but in all educational disciplines.

References


Notes from reader

Strong and honest essay written by three (independent) authors. The style and argumentation change from paragraph one to paragraphs 2 & 3, and the rest. The last paragraphs endorse the key points advanced in the COE. Just like the COE SP, there is no exploration of the means needed to enable the envisioned educational changes. However, the constraint of a four-year BS degree education remains.
As the world continues to evolve, faster than ever before, the world seems to shrink and flatten; more and more countries’ economies are becoming knowledge based instead of production based; and it becomes necessary for the inventors of today to be ready for the challenges of tomorrow. Therefore, it is crucial to revolutionize the engineering education of last century that is still being used today into the education of the next century that is needed now in order to compete with foreign counterparts and help our already frail economy. Education in most other countries is rapidly improving while ours remains static. The cost of living in said countries tends to be lower than that of the United States, which gives their graduates the ability to offer the same services, offered here but for much lower rates.

By becoming an institution of choice, a standard upon which other universities are measured, the Dwight Look College of Engineering hopes to provide, not only to the nation, but also to the world with engineers that are not only problem solvers, but also innovators. Achieving this status will provide the program’s graduates the best education while allowing the program to grow and acquire the resources to continue the research and development that makes it a leading entity.

Aristotle once said, "For the things we have to learn before we can do them, we learn by doing them." Experiential learning is just the reflection of this concept. Experiential learning theory defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience." [1] Through our senses, we are able to take in information, yet we get to learn them ultimately by doing. First we watch and listen to others to getting the information which will spark interest and motivation on us; and finally we are set to experiment our knowledge into our actions. This is called experiential learning. Different learners have different experiences, and they will be able to create a new perspective on the same experiences. Without the integration of our knowledge into the practical field, we are just passive participants and passive learning alone doesn’t engage our higher brain functions or stimulate our senses to the point where we integrate our lessons into our existing schemes. Texas A&M University has provided
students with opportunities like co-ops programs, internships, student exchange programs, free workshops, and many engineering club activities which integrate knowledge into a practical field. Also, many undergraduate students get involved in research programs with professors and graduate students, and which expose them to a practical field, rather than just academic, and thus induce critical thinking.

Texas A&M University has outlined different plans to get student more involved in experiential learning, and thus gain more critical thinking among the students. The administration wants to endow student-supported and student-reviewed grant programs supporting the development of hands-on courses. It also plans to incentivize course development by increasing the weight such courses apply to the teaching obligation during the development semester. Also, creating teaching mentorships held by upperclassmen who create and present student-designed and faculty reviewed demonstrations in the classroom is another approach toward experiential learning. In addition, the administration plans to encourage innovation in the format of course assignments by creating more open ended questions, through which students must first define the problems before creating a solution. Above all, the administration plans to create physical spaces that support development of sets of learning outcomes for innovation.

Conducting scientific research allows for the attainment of many new ideas and discoveries. At a university, students attend higher education to do just that – learn new things. Engaging in researching alongside classroom activities would broaden input from one’s field of study and allow for more interaction with a subject. This increase in higher learning could potentially lead more students to earn even higher degrees and increase our country’s intellectual prowess. This is especially important because “a premium will be placed on the ability to quickly transform ideas and concepts into technological products that will create value in the modern economy.” [2] Clearly, undergraduate research places more students in the position to discover new ideas and breakthroughs that could benefit society a great deal.

Learning how to learn is an integral part of education and life in general. One of the biggest challenges for students is learning how to learn. Adapting to new educational and life challenges characterizes human intelligence and ingenuity and sets us apart from
unintelligent life and technology. Many students and educators agree that memorizing how to work a problem and regurgitating information onto a test paper is not effective education. **In order for students to learn how to learn they must be presented with unique and challenging problems by involved and caring educators. Only in this way can students get better at adapting to more challenging and increasingly unique problems**, such as they will face in the real world. Such an educational standpoint also fosters “lifetime learners”- people who are curious about new problems before the problem presents itself. Such lifetime learners are motivated by curiosity and a desire to be innovative and creative. **So lifetime learning and learning how to learn really go hand to hand- teaching people how to solve problems that are interesting and engaging rather than mundane and formulaic problems that are unrewarding and burdening is the path to making true learners.**

The Strategic Plan really does **not** specify exactly how the university will achieve the Strategic Plan’s goal but it does lay down some basic groundwork on the solution of accomplishing the goal. The Strategic Plan needs to address the issue of credit hours; in order to increase the quality of education, classes will have to be of a higher quality and there will have to be more required classes. The increase in number of classes such as mathematics and physics will allow the students to have a much better understanding of these subjects that will allow the students to have a much better knowledge for future endeavors.

The ‘learners’ of tomorrow are taught by ‘doers’ of today. In other words, current students will serve as teachers for the next generation. Because of this, they will look to us for our wealth of knowledge and valuable experience; much like we do our previous generation ourselves. As corollaries of Texas A&M’s Vision 2020, our actions will have a serious impact on the ‘learners’ of tomorrow. **Because of this, it’s imperative we do our best.** To accomplish this, we must constantly push the envelope on what we know, and be prepared to relay that information backwards. That way, the next generation has a stable foundation. In addition, an environment friendly to innovation and technological advancement must be preserved! By doing these, a world that challenges and offers tremendous opportunity is preserved, thus making the students of A&M brighter and more competitive.
References

1. Kolb, A., & Kolb, D. A. (1999). Bibliography of research on experiential learning theory and the Learning Style Inventory. Department of Organizational Behavior, Weatherhead School of Management, Case Western Reserve University, Cleveland, OH.

2. “Strategic Plan 2011-2015”. Bennett, G. Texas A&M. College Station, TX

Notes from reader
Excellent essay with strong and lucid argumentation. The style is impeccable throughout. The discussion does address the issue of quality education perhaps with more credit hours. Thanks!
Texas A&M University is a publicly funded state institution. Its main role is to provide the education to the people of Texas and to provide the state with educated graduates prepared to meet the demands of the state economy. However, these goals are not well regarded in terms of becoming a top 10 national public university. An institution of choice will provide an education that will prepare a graduate for the jobs in Texas, but career paths in a global, diversified, and changing world. This dual capacity, will allow Texas A&M to improve its national and global image, and ranking, while still providing for the state of Texas.

Experiential learning is curriculum that encompasses adaptive, creative, experimental, entrepreneurial, societal and global learning. These curriculum requirements help students to develop the mindset, though processes and skills needed for real world application. I believe that the TAMU UG education has prepared me quite well on this aspect. It is becoming most evident in my Senior Design courses such as 401 and 404.

There are several planned activities for students to gain critical thinking – grant program, incentive courses, teaching mentorships, and innovation through course assignment. I think the current UG education is lacking a bit in this area. Students can execute these activities but I do not think they are easily or often sought out. Most students seem to do what is required and not go too far above and beyond.

Research is important for undergraduates to understand the research process and experience. It is also crucial to young engineers in determining their future career path. Exposure to research can change a student’s life by allowing them to see and consider a future in graduate school and research opportunities. Most students entering into college do not know how to learn in a way that will benefit them throughout their career. Dean Bennett suggests strategic assessments in order to gage a commitment to life-long learning. It is hard for most students to correctly gage their abilities and having more information about their abilities relative to the listed outcomes, such as, reasoning, understanding, diversity, and experimentation, enables them to assess what they have learned and how to continually apply these results to their lives.

As a graduate, your responsibility towards your alma mater will never fade away. The better that you perform as a professional engineer, the higher your school will be looked up to as a quality engineering school. Therefore, if Texas A&M produces a few year of sub-par engineers it will bring down our school ranking and hurt future students chances at getting a job. This is not the only responsibility that you have to your alma mater; you can also give back by coming back to the school and giving your opinions to the staff and presentations to the students. This will allow you to help the students be prepared for the real world and hopefully correct problems that you may have encountered. Education is the most important gift that we can give our children. Everyone wants their kids to have the opportunity to achieve the best education possible. This is why everyone must work together to make this goal a reality.

Notes from reader

References – none! Interesting essays shows passionate arguments written by two (independent) authors. The style and argumentation change from paragraphs one/two to paragraphs 3-5. The last paragraphs endorse the key points advanced in the COE and calls for everyone to do his/her part and more.
Assignment 4 - Team Hoof-Hearted

As time progresses it is becoming more and more apparent that we are experiencing a trend towards globalization and creation of a “knowledge-based” economy. Because of this it is vital to transform the undergraduate engineering education to produce graduates that are both innovators as well as effective implementers. This transformation must occur now to bolster the United State’s engineering chance at staying competitive globally.

One of the main goals of Texas A&M is to be an “institution of choice”, but what does that really mean? The University has recognized that the world needs graduates who can create, recognize, identify, pose, formulate, and refine future solutions, innovations and breakthroughs. Therefore the goal is to stimulate and teach students how to break away from the easy path of simply solving the problems given to them, to a path driven by a clear vision and passion. This transformation will be helped along by having a foundation of experiential learning, which exposes the students to solid research findings and the best engineering practices around. Experiential learning (adaptive, creative, experimental, entrepreneurial, societal, and global) will be combined with design work; all running through out the four-year undergraduate degree program, creating a “spine” of courses and experiences. The hope is that this spine will better prepare graduates for the demands of their courses and future jobs. A common complaint by professors and even industry is that graduates need to be more prepared for the mindset, thought processes, and skills sets for designed-focused projects. Through adaptation of current course curriculum it is hoped that students will build more accurate mental models of what the engineering thought process is and thus be more prepared for their ventures in industry. Research is important in this aspect as being update date on what is new is how one stays in the know and ahead of everyone else. Learning to identify findings that might have a useful practical application is another important piece of the “spine” the University hopes to create.

Another discipline A&M hopes to leave with its students is the idea of being a lifelong learner. Too often students have the misconception that once they get settled into a job, the monotony begins and they will never learn anything new. This, we all know, is about as far from the truth as you can be. This is why the University wants to teach graduates how to learn effectively and to continue to learn effectively. Right now the proposed system is that a progress check will be implemented after each semester assessing how the student has become closer to reaching the objectives of the program as a whole in the hopes that the student grasps that he is in control of what he learns and to what extent; to ignite the spark of the desire of knowledge that will continue to burn for the graduates entire life.

Although the University has plans set to transform the curriculum and help better prepare us all for the future, in the end we are all arbiters of our own education. The students themselves must have the drive to push the boundaries of what we know as possible today. Through being exposed to real world research and experimental learning, an impact is made on the student however small it may be, which better the odds of producing life-long learners who are competitive and valued in the world market.
Resources

<http://rotorlab.tamu.edu/me489/Assign_4%20The%20COE%20Strategic%20Plan/>


<http://www.engineeringchallenges.org/>.

Notes from reader
Interesting essay. Some odd sentences and typos found. It shows well placed arguments yet does not answer a question posed. Essay does not discuss the resources to enable the change.
GOAL 1.1: Base the transformation of engineering education on a foundation of experiential learning, drawing on solid research findings and best professional engineering practice

In today’s society technology is improving at a more rapid pace than ever. This improvement, being directly related to changes in the engineering profession, has spurred many institutions to strongly consider reforming the way they educate undergraduate engineers. Texas A&M recognizes and understands the implications that the fast-pace technologically advancing society has on graduating engineers and is planning to transform their program accordingly [1]. If universities continue to teach only individual technical skills their graduate engineers will not be able to effectively bridge the gap between new technologies and new products hitting the market which utilize that new technology. This has become a very important skill that is highly valued, giving engineers that can effectively implement this skill an advantage as they seek employment opportunities.

Texas A&M University’s desire to become an institution of choice is initiated by a three-fold goal for its students and university as a whole. The university is implementing a plan that will result in “successfully placing graduates on a broader national and international employment arena, solidifying and validating institutional reputation and enhancing the diversity and potential of incoming undergraduate and graduate students.” [1] Texas A&M will have more successful current and future students, as well as more valuable research by becoming an institution of choice, and will thus attract brighter, more driven undergrad and graduate students and professors. These incentives serve as the driving force for Texas A&M’s drive to become an institution of choice.

Experiential learning can be defined as creative learning, in that students do not focus on textbooks and formulas, but rather gain valuable experience by completing hands-on tasks. This type of learning is an important component of a students undergraduate education because it allows “students [to] build more accurate mental models of engineering thought processes and how what is learned in an undergraduate curriculum can be applied after graduation” [1]. Combining experiential learning with engineering curriculum prepares students for challenges they may face in their future careers. The TAMU UG education emphasizes experimental learning by incorporating courses that are not based solely on exams and homework assignments. Experiments and design projects are components of many courses throughout a students undergraduate education at Texas A&M.

In order for students to gain critical thinking skills, a plan of action was developed that implements five key tasks. These tasks are aimed at creating “real-world application and problem-solving environments demanding multi-disciplinary, team-
based solutions” [1]. The planned activities include assignments that require innovation and creativity, developing teaching mentorships among students, and a grant program to continue to develop courses that emphasize experiential learning. The current UG education has been adequate in teaching more than just how to solve engineering calculations. Many assignments and exams have required critical thinking rather than basic problem solving skills. In addition, course projects have introduced collaborating with other students to reach a common solution to a problem.

Research is important to undergraduate education. The National Academy of Engineering has made “research experience” the first component of their program to prepare the next generation of engineers [2]. Under graduates being involved in research over the course of their career helps develop the mindset, thought processes and skill sets needed to produce graduates capable of contributing to the newer, less-traditional, fields of engineering that they are likely to enter [1]. New areas of engineering develop more and more quickly; adaptable engineers are needed to be successful in this new world.

To adjust to these these dynamic developments in the direction of engineering, practicing engineers must be willing and able to continue learning throughout their careers. Knowledge is expanding so quickly that information learned quickly becomes obsolete. To be valuable, engineers can't depend on previous knowledge for the duration of their careers; they must continually learn new fields or even new technology that can be applied to their field. This learning can be tracked by maintaining records of conferences attended or universities can provide classes for practicing engineers to receive knowledge of new fields and new technology. Their performance in these classes could be graded and officially recorded to show dedication to learning.

While the Strategic Plan (SP) released by the College of Engineering (COE) does not address quantitative values for credit hours that will address the transformative education, it does describe a plan to institute a “spine” of courses throughout the undergraduate curriculum addressing the need. The SP states that some of these may be new courses altogether, and some may be slight curriculum modifications to current courses, but the goal is to increase students' exposure to experiential learning and design. The COE hopes that in the future, by the time students reach their capstone design courses, they will have already developed the skills and thought processes necessary to succeed (beyond the technical content). The ultimate goal of this initiative is to better prepare Texas A&M students for applying their technical knowledge in the real world. The SP states, “Such courses at all levels would help students build more accurate mental models of engineering thought processes and how what is learned in an undergraduate curriculum can be applied after graduation” [1].

One of the most daunting challenges to overcome for academia is to bridge the gap between education and practicality. While it is clear that students must have strong technical knowledge upon entering the work force, what is not as obvious is which other skills they need to be successful. Almost certainly, the most effective way to overcome
this challenge is to develop effective communication between industry and academia to enable quick and appropriate adaptation to the curriculum. **Often times, professors, department heads, and the Dean of the COE are so focused on education that a risk forms in that they may lose touch with what is happening in the real world.** Fortunately, the COE is very active (particularly the M.E. department) in industry Advisory Councils (ACs). These boards, comprised of executives and experts from various fields and companies, enable the aforementioned communication between industry and academia. The AC can provide feedback on changes in the curriculum, ensuring that the experiential, cultural, and practical experience the students obtain through their coursework is effective in preparing them for work in the industry. This challenge is much greater than before with such a global, innovative, and culturally diverse workforce. **The days have long since passed when the only thing engineers needed to be successful was strong technical expertise.** Fortunately for Texas A&M students, the COE recognizes this need and is working hard to initial Goal 1.1 of the Strategic Plan for 2011-2015.

**References:**
1. TAMU COE Strategic Plan

**Notes from reader**
Excellent essay detailing rationale and scope for a major change in engineering curriculum. Thanks!
References are not full (incomplete)