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Lt. Col. Marcus L. Roberts, U.S. Air Force Academy

Marcus L. Roberts, Ph.D., is an Assistant Professor in the Department of Electrical and Computer Engineering at the U.S. Air Force Academy. Email: marcus.roberts@usafa.edu.

Major Randall Deppensmith, U.S. Air Force Academy
Capt. Ryan Jay Silva, U.S. Air Force Academy

Ryan J. Silva, M.S.E.E., is an instructor in the Department of Electrical and Computer Engineering at the U.S. Air Force Academy. His research interests include FPGA architectures, cryptography, and embedded systems. He is a member of Tau Beta Pi and Eta Kappa Nu. Email: ryan.silva@usafa.edu.

Observations From First Year Instructors: What We Wish We Knew Before We Began

Abstract

In June 2010, we reported to the United States Air Force Academy to teach in the Department of Electrical and Computer Engineering. Each of us brought different skill sets, different experiences, and different interests from different jobs in different locations. Yet, throughout our first year we simultaneously observed common stumbling blocks leading to some dilemmas and curiosities. This paper presents some of these common observations from three dissimilar instructors within a contextual framework promoting a learning-centered paradigm and balancing technical syllabus content with real-world "soft" skills. It is not our intention to define these observations as "Tricks of the Trade" or "Best Practices," although some recommendations are made. Rather, our intent is that these 10 observations will open dialogue in other institutions and departments to collectively address these issues.

Introduction

Many students anxiously begin each academic semester with apprehension as they wonder what challenges the next few months may hold. First time instructors may very well begin the same way, wondering if they will excel or just survive the first semester. This paper provides the top 10 observations from our first year experiences with a central focus on "what we wish we knew before we began."

The Air Force Academy is fully vested in promoting a learning-centered environment[3,4] for students. That is, the school is committed to ensuring teachers are dedicated (and responsive) primarily to student learning and not instructor teaching. In fact, upon our arrival, we (and all other new instructors to include returning instructors and distinguished visiting professors) spent our first week in Learning Communities engaged in various forums, briefings, and panels to establish a common reference from which to begin instruction. As such, when the semester began, student learning was our primary focus, which kept us from retreating to packed-and-hardened memories of antiquated teaching techniques we endured during our college years. We believe this initial common exposure to student-learning strategies contributed to the common observations we share within this paper.

We believe these observations to be universally applicable to all instructors (beyond merely Electrical Engineering or even engineering at-large) provided the following caveats are met: 1) a learning-centered environment for students is the underlying paradigm for the classroom instruction, 2) the course is required (e.g., a core class), and 3) the instructor/student ratio is small (i.e., manageable).

The observations cover a wide gamut of teaching/classroom strategies and execution, but here are the observations we address in the paper. These observations are explored further within the paper to include explanations, recommendations, and probing questions.

1) Concepts are more important than details.
2) Real-world relevance is easier said than done.
3) Determining the proper scope of material for the classroom is an art, not a science.
4) Spoon-feeding students is simultaneously necessary and harmful.
5) Grading is best learned through experience.
6) Students are not the only ones expected to adapt.
7) A learning-focused approach can and cannot be successfully applied to STEM courses.
8) Long-term memory is unlikely to occur unless a student is motivated.
9) Enthusiasm is a highly underrated attribute of successful instructors.
10) The most important lessons students learn are not found in the syllabus.

All three of us are now completing our second year of teaching, and feedback (anecdotal and/or quantitative from anonymous end-of-semester student feedback, classroom experiences, and supervisor auditing/feedback) is positive thus far. We believe that new and old instructors alike can benefit through review of these observations and discussion of the dilemmas and questions that are raised.

The rest of the paper is organized topically. After introducing the general theme of the paper, a terse background briefly orients the reader to the Faculty Orientation offered to all instructors at the Air Force Academy and the unique Air Force-specific issues which may or may not skew some of our observations. After that, the paper presents each observation one at a time. After clearly stating the observation, we introduce recommendations, probing questions, dilemmas, and/or other supporting documentation for the observation as we build our argument. Finally, we conclude with a summary of information herein.

Background

There are several key factors that may somewhat bias our observations; yet, we believe they remain universally applicable. First, the Air Force Academy believes so strongly in the learning-focused paradigm that all new instructors must attend a Faculty Orientation each summer. For the record, approximately 100 new faculty members arrive each summer, which represents a roughly 20% turnover each year. Within this week-long Orientation, instructors are teamed with about 10 other inbound instructors as they sit through forums, briefings, and panels discussing learning-centered instruction and real-life teaching scenarios with experienced faculty members.

Second, at the Air Force Academy, each Department controls its own hiring process. Oftentimes, instructors are not selected based on their prior instructor experience, post-doctoral research, or general academic prowess (although those factors would certainly enhance an applicant's chances). Rather, other factors are considered as strongly, if not more so, than just a graduate school transcript, publishing record, or academic prowess. For example, letters of recommendation and annual Air Force performance reports make up an important part of the evaluation process. Most Air Force officers lead people, manage programs, and have experience briefing audiences in different venues and levels. Thus, the whole person concept is applied when selecting candidates. Through this process, all three of us were selected to teach. Although none of us had formal instructor training or experience, we all had a successful track record in the Air Force. With that experience, our department hopes we can motivate cadets to learn, realizing their instructor has "been there-done that" in the same military they will one day serve.

Third, we have an advantage of knowing that each of the graduating students will "join the company." Whereas an educator at a civilian institution may need to generalize teaching or select examples from a selection of different industries, we can tailor our examples to the Air Force. This fact certainly does not make our observations less relevant; it simply means that we have an advantage in attacking some of the observations below. While we cannot start on-the-job training (since most students won't find out their jobs until their senior year and they won't find out their Air Force bases until about 100 days before graduation), we can provide proper motivation and context for the instruction.

Fourth, we teach 17-24 year olds who were selected from a stringent selection process[1]. They are clearly young, bright, and talented, although that does not equate to motivation. Furthermore, being a military institution, our students are required to attend class to avoid punitive discipline. So, we have the advantage of having bodies in seats, and generally, those bodies are capable. For us, the challenge becomes more about motivation and teaching engineering to non-engineers[2].

Observations & Recommendations

Despite our different skill sets and interests within the broad field of Electrical Engineering and despite our different experiences and backgrounds within the Air Force, we all simultaneously observed common stumbling blocks within the classroom during our first year of instruction. The subsections that follow clearly articulate our common observations with accompanying recommendations, probing questions, and supporting dialogue as appropriate. In some cases, the observation clearly goes against the grain for seasoned instructors, and in other cases, the observation clearly states the obvious. However, in all cases, the observation is founded on a learning-centered paradigm[3,4] and an assumption that you are an expert in the subject you're teaching. Furthermore, the key is not only the observation, but the resulting dialogue we hope that these statements produce in other institutions and departments. Most certainly, each of these points could in and of themselves spawn multiple papers. However, as a reminder, our purpose is to broadly state these observations and to initiate dialogue on this topic.

Observation #1: Concepts are more important than details.

If the goal of instructing is student learning, then concepts are more important than details. This "if" statement is not necessarily a given fact, for all of us can probably recount instructors along the way whose focus was not on student learning, but rather research, retirement, personal interests, advancement, etc. However, given that student learning is the primary goal for an instructor, we observe that it is paramount that the students learn concepts before details. As engineers, it is somewhat ironic that we are espousing the value of concepts over details because we are naturally detail-oriented, but we think that begs the point: this observation is even more important for engineers (or Science, Technology, Engineering, and Mathematics [STEM] students in general).

Unfortunately, this is not the way most college students want to learn. Some students seek success before learning and are primarily GPA-driven. These students just want the right equation to solve the right problem and get an A, whether that means they understand the material or not. Perhaps this technique served them well in high school and they were naturally bright enough to succeed at that level. Other students, especially STEM majors, are just naturally curious, sometimes to their own detriment. Before understanding the concepts of the current lesson, they begin seeking details on minutia without understanding the bigger picture of where that instruction fits in or why they are learning that concept in the first place.

So, what's an instructor to do? After all, equations *are* relevant and details *are* important. Instructors must frame their classroom presentation and assessment to emphasize concepts, yet still present the mechanics of problem solving and assess the students' skills in that area. It's difficult to make specific recommendations for this observation, because the manner in which an instructor teaches is personality-, classroom-, topic-, and even age-dependent. Regardless of the manner employed, the students that understand the concepts generally do better on assessments, losing minor points to math errors, incorrect units, etc. rather than major points to an incorrect understanding of the problem at hand. The students that do not understand the concepts may succeed, but they certainly stand a larger probability of failure because they have no connection between concepts and details. This probability of failure will increase as they progress in higher education.

One technique we have used with success in our core Electrical Engineering class is the use of Bottom Line Up Front (BLUF) statements. (Note: all Air Force Academy students must take this core class as part of their Bachelor of Science requirements.) BLUF statements are used throughout the Air Force, and they are nearly universal and mandatory at the General Officer level in the Pentagon. At the beginning of class, we offer 2-4 BLUF statements that conceptually tie in to that day's lesson. As we cover the details in class, we refer back to the BLUF statements. As a result, the students are more prepared to make a connection between the details of problem solving and the overall concepts we are reinforcing in that lesson.

Observation #2: Real-world relevance is easier said than done.

One of the ways instructors can emphasize concepts more than details is to generate academic problems that mimic real-world situations or introduce real-world situations that emphasize a fundamental understanding of the problems at hand. This leads to our second observation that real-world relevance is easier said than done.

With the exception of the most experienced/skilled instructors or the most naïve instructors, most instructors would probably agree with this observation. It certainly doesn't seem controversial. However, one of the sticky points of this observation is that that the example or demonstration used in class to relate theory to the real-world must be applicable to the students. If they cannot identify with the example or demonstration and relate it to their world, it's merely another academic exercise. It's irrelevant. So, we casually opine that the "relevance needs to be relevant." Beyond the need of the "relevance to be relevant," well-intended instructors become so consumed with the syllabus or lesson plan, they forget to plan specifically for these examples.

If proper planning prevents poor performance, than certainly improper planning promotes poor performance.

So, how can an instructor properly incorporate real-world relevance into the classroom? Well, certainly, the gray-beard instructors, seasoned with experience, carry much credibility and a wealth of examples. But, what about newer instructors, for whom this paper is primarily written? Unfortunately, we have neither the answers nor the experience to provide a satisfying answer. Instructors must thoughtfully prepare each lesson and graded event within the syllabus, and while doing so, must consider real-world relevance. Student feedback is probably the best starting point for this problem. Ask them point-blank for their own examples (most certainly, some will have had some work or hobby experience) before/after class or give them a formal feedback tool (like an end-of-semester feedback form). If you take this approach, keep a record of the feedback, or it may soon be lost.

Despite the fact that we have *a priori* knowledge that each student in our class will "join the company," our inclusion of real-world relevancy into our lesson plans faces the same harsh critics. For example, during our lessons on radar, it's very easy to convince the majority of the students why the topic is important, and we can draw on our own experience within the Air Force to make the examples more meaningful. However, not everyone will become a pilot or intelligence officer or acquisition officer. How do you convince the future medical doctor or lawyer that this topic is relevant to their future as well? Again, we have no satisfying answers, and we simply bring up this example to support the observation.

Observation #3: Determining the proper scope of material for the classroom is an art, not a science.

Even if you've decided that concepts are more important than details and you've included real-world relevance in your lesson plan, there still does not exist a cookie cutter approach for fleshing out the complete lesson plan. Thus, our third observation is that determining the proper scope of material for the classroom is an art, not a science.

There are numerous variables that can affect the proper scope of material for a particular class. By "proper scope," we mean that the lesson plan must be the right length for the allotted time and planned activities, and that the lesson plan must be of the right depth to challenge the intended audience and meet the lesson objectives. It may be tempting to simply pre-define the amount of time for each event, e.g., 10 minutes for quiz, 40 minutes for presentation, 10 minutes for questions in an hour-long course. However, that approach forgets one very important variable: the human. The human teacher, the human student, and our human way of thinking certainly add, in military colloquialism, "fog and friction" to the planning and execution of a lesson plan.

We were forewarned and yet we still experienced first-hand the challenges of scoping the material for the classroom. Throughout the semester, each of us was able to do so and be very comfortable by the end of the semester. However, we all approached it differently, because two of the variables that contribute to the process are predominantly "human" -- the teacher's personality (or classroom presence) and the teacher's past non-classroom experiences. It is a "science" to develop a lesson plan. However, it is an "art" to scope that plan so that it's of the right duration and depth for the class.

For example, assume that you are discussing power generation, and you want to tie in real-world relevance (see Observation #2). As such, you plan to show some examples of where we get our power and how we use it before teaching the details of power transmission, etc. If you do not artfully consider the time you allot for these examples, to include questions that students may ask, and the depth at which you present the material, in conjunction with the objectives for your course, you may find yourself in this quandary: your scientifically generated lesson plan may fail. And seeing as how most things in the classroom take longer than originally planned, the chance of failure actually increases as the applicability of real-world relevance rises (after all, that would generate more student interest).

A final comment on this observation needs to be made. For whatever reason, a minority of instructors (but larger than should be) rely solely on Adobe (i.e., pdf) or PowerPoint (i.e., ppt) to guide their lessons. For some classes, this technique may actually be the correct one to engage student learning. However, for most classes of this generation, those presentations may not promote student learning and may be an ineffective use of instructor time. In fact, if this is the sole teaching method, why not just have the students read the presentation as a second text? A learning-based method of teaching allows time for questions, discussions, and moments of pause and reflection, not just presentation. At a minimum, these tools should be used sparingly and they should only guide the discussion vice present the lesson word-for-word. Each instructor will scope their lesson differently, but we are certain that is an example of not properly scoping the lesson plan.

Observation #4: Spoon-feeding students is simultaneously helpful and harmful.

As you develop a cohesive, artfully constructed lesson plan teemed with real world relevance and emphasis on concepts, you will naturally exhibit a stronger desire for students to demonstrate learning and apply critical thinking and solve problems with understanding and the list goes on. Yet, one must exercise caution and temper that strong desire for student learning by spoon-feeding students in proper dosages. At times, maybe weak times or simply lack of time, even the most stoic and rugged instructor is prone to spoon-feed material to the students. Is this bad? No, but it leads us to our fourth observation that spoon-feeding students is simultaneously helpful and harmful.

We realize that this may be a very controversial or even confusing observation. At some point in our lives, we've all been babies, toddlers, small children, etc. We did not enter this world knowing how to do everything. Our parents (or guardians) fed us until we learned to eat, they held our hands until we learned to walk (and even after we learned to walk), and they took care of us until we were independent enough to care for ourselves. Why would learning Engineering or English or Economics be any different?

If we polled a large group of instructors, there would no doubt be some who favor spoon-feeding and they would justify it with the analogy above. Conversely, there would be some who abhor spoon-feeding and they would justify it with an independent learning-focused argument. We won't even hypothesize the distribution in each of these two camps, but we simply note: spoon-feeding is very helpful for immediate learning, but it can be very harmful to long-term learning. The wise instructor is one who finds the proper balance of when to spoon-feed (or when to stop) and how much to spoon-feed (or how much not to) while promoting student learning.

Consider a course in which three labs are conducted as part of assessing student hands-on learning. It would be very helpful to student learning if you walked them through the lab step-by-step (via oral instruction or handout) during Lab #1 and told them exactly what buttons to press, what phenomena to observe, what learning is taking place, etc. After all, it could be the very first time they've ever seen the equipment. However, if you are still taking these baby spoon-feeding steps on Lab #3, you are acting as an impediment to student learning. As the ancient Chinese proverb states, *Give a man fish; feed him for a day. Teach a man to fish; feed him for a lifetime*. The spoon-feeding dosage applied in class should be a measured approach to get your students to "fish" for a lifetime.

Observation #5: Grading is best learned through experience.

Within weeks of teaching our first class, we had our first experiences with grading: quizzes, labs, exams, etc. It was challenging to say the least, and we were very thankful a cut sheet existed to help us internalize the process, weighting, etc. Yet, we realized our fifth observation very quickly. Grading is best learned through experience.

Without the cut sheet developed by the course director with experience in the course, the initial challenge may have been tirelessly frustrating. However, even with a standard grading rubric, we still spent a large amount of time ensuring equitable scores for equal student efforts and performance. The fine detail in the cut sheet, while well thought out for many conceivable solutions or techniques a student may use to solve a problem, created a minutia of details to grade against. Without the acquired skills to assess student learning, we tended to spend time comparing student's grades to each other's. Instead of grading for total level of learning, we spent an exorbitant amount of time focused on trying to make sure we "nickel and dimed" every student equally, consistently assessing the same penalty for the same errors. In a sense, precise grading became more important than measuring student learning. As a result, we missed the forest for the trees and were less prepared to adjust course topics and class lectures for the overall goal of student learning. For even the best designed rubric cannot accurately reflect student learning without including instructor intuition.

After a semester grading against a rubric, our instructor intuition and grading confidence quickly grew. Within this maturation process, we became more adept at focusing on the overall learning and less concerned about missing a point here or there between students. Additionally, since we taught a well-developed course that offered a multitude of grading assessments, we didn't need to worry about missing a random point as our grading migrated from lock-step implementation of a rubric to intuition balanced by the cut sheet. After the summation of multiple assessments, any small errors for a single event would become negligible. We think it's a fair trade to focus on the overarching fundamental concepts of the course rather than focus on a few missed points for small mistakes such as a sign error. In the end, the student will get the right grade and the grade they deserve.

However, if you do grade simply on instructor intuition, we offer a cautionary note. If we had not spent one semester relying solely on the grade sheet, our instructor intuition would have not matured. As a result, we probably would have had an abundance of grades in the middle of the grading spectrum. Without the cut sheet as a reference to fall back to, the assessment of student learning may tend to become diluted placing everyone in the C+-to-B+ range.

So the summation of our experience regarding first term instructor grading comes down to two points. First, trust your intuition but be aware that grades tend to pile up in the B/C range if that is all you do. Second, balance your intuition off of a cut sheet or rubric if you have one developed by an experienced instructor, but don't go too far in pinching points between different student assessments. Your time is better spent on adapting your lessons plans (see Observation #3) based off of general grading trends which serves all your students better then awarding a few extra points to one particular individual because of the cut sheet.

Observation #6: Students are not the only ones expected to adapt.

Developing a knack, or mature intuition, in your grading process will provide quick, valuable feedback for the classroom, but at that point is it already too late to apply course correction? Maybe. The reason is based on our sixth observation that students and instructors must each adapt.

If student feedback is gleaned from their performance on graded events and formal assessments, then feedback comes at the cost of course material comprehension. If students perform poorly on a block of material and the instructor makes appropriate corrections, it does not change the fact that the students did not grasp the previous material. This dilemma could be solved by facilitating an environment where students are expected to demonstrate their learning well before being formally assessed.

A common thread between learning-centered and teaching-centered environments is that students are expected to take responsibility for their own education. In both environments, the student must adapt to succeed. The major difference between the two philosophies is largely in how the instructor facilitates that education. The stereotypical teaching-centered classroom is one in which the instructor talks and students listen. This particular style of instruction is very passive on the students' part; it's a one-way street where student feedback only occurs after graded events and formal assessments and after it is too late to modify the presentation of material. So, what is an instructor supposed to do? The answer we've found is that instructors must adapt to their classroom, and each classroom has differing needs, demographics, interests, and personality.

The foundation of a learning-focused classroom begins with student interaction, where student needs are identified and student learning is active, not passive[5]. Student interaction should occur every class period in order to gauge the effectiveness of instruction lesson-by-lesson. When teaching multiple sections of the same course, it is easy to assume student learning is uniform across classes. We have found that this assumption is usually faulty. The methods used to successfully instruct one section of students may be rejected by another section of students. This concept applies to course material as well as instructional methods. Just because one class understands a particular concept immediately does not necessarily indicate that it will be so easily absorbed by another. In both cases, the instructor should remain flexible in their facilitation of student learning in order to better adapt to student needs that fluctuate between sections.

If this observation implies that instructors should adapt to student needs, does that mean instructors should adjust their teaching style in order to accommodate 100% of the students in a particular section? While 100% may be too lofty and unachievable, we do believe that instructors can properly instruct a high percentage of students without falling into the 80/20 trap as we discuss in the next observation.

Observation #7: A learning-focused approach can and cannot be successfully applied to STEM courses.

If a teaching-focused environment doesn't respond quickly enough to adequately facilitate student learning, what can be said about a learning-focused classroom? The mental image of a clichéd learning-focused classroom might involve students and an instructor sitting in a circle participating in a discussion on a topic related, perhaps loosely, to the course syllabus. Students in this setting are responsible for steering the discussion and for answering each other's questions, all while an instructor acts simply as a resource for information. What one may not find in this picture of a stereotypical learning-focused classroom are equations, calculators, and lab equipment. This begs the question: can a learning-focused approach to education be applied to engineering? Our answer is yes…and no.

One of our primary methods for evaluating student learning outside of graded events is by having groups of students solve example problems on whiteboards that surround our classrooms. Students may respond differently to board work, which is apparent in their course feedback. Comments such as "Quit walking us through the example problems, let us figure them out on the board" and "Get rid of board work, I need this stuff explained to me" are often found side-by-side within a particular section's feedback. Even students disagree as to whether or not a learning-focused approach can be applied to engineering.

It could be argued that in a stereotypical learning-focused classroom, the instructor follows the discussion as steered by the students. This could prove troublesome for an engineering instructor teaching a high-enrollment core course. When we first started teaching the core electrical engineering course at the Air Force Academy, the course had 19 sections of students (approximately 350 students) and nine different instructors, which necessitated standardization in material and evaluation methods. These standards are dictated by a single course director and cannot (and should not) be easily adjusted. The material that students will be responsible for on an exam may or may not be covered during a student-led, free-flowing discussion. In more advanced engineering courses, we have also noticed a tendency for student-guided discussions to dawdle on the particulars of less difficult concepts at the expense of peeling the first layer off of a more difficult topic. Either way, the material on the exam remains the same regardless of what is covered in class.

Another stumbling block for an instructor using a learning-focused approach in an engineering classroom is the 80/20 trap. Some technical material may be difficult for some to grasp and this could lead to an instructor spending 80% of their time/effort focused on 20% of students. The 80/20 trap can also be self-laid by a well-meaning instructor attempting to be so flexible as to accommodate 100% of his students, which could lead to spending an inordinate amount of time trying to satisfy a minority of students. In the next observation, we describe how motivation is critical in order to have an impact on long-term memory, but motivation is also the key element to battling the 80/20 trap. We have found that if an instructor can motivate the 80% of students, this may spill over to the remaining 20%. Motivation is highly contagious!

Observation #8: Long-term memory is unlikely to occur unless a student is motivated.

Consider an instructor who artfully and scientifically develops a lesson plan, executes it flawlessly, applies real-world relevance, and highlights important concepts while doing so. Sounds successful right? Not necessarily. Learning is only guaranteed if the material gets into the students long-term memory, and our eighth observation builds upon this fact. Long-term memory is unlikely to occur unless a student is motivated.

Obviously, for this observation (and others as well), the onus is on the student to engage their 3 P's for success: prepare, participate, and perspire. Yet, as instructors, we should facilitate this learning-centered environment, and furthermore, we instructors are highly capable of motivating students (see Observation #9). Research on memory clearly states that students retain learning for the long-term when they integrate the new knowledge with existing knowledge[6,7,8], and as instructors, we can motivate this knowledge integration.

The corollary to this observation implies that an unmotivated student will be highly unlikely to achieve long term memory and permanent learning. In our Department, we see unmotivated students all the time. Unlike civilian schools, they cannot skip a class; otherwise, they face disciplinary measures. Also, because every student is awarded a Bachelor of Science degree, they take a wide breadth of core classes, many of which they do not like (e.g., ECE 315). So, imagine our struggle to motivate when we teach a class at 0750, with the students half asleep and half of them wishing they didn't have to take the course. To them, the course is a necessary evil and another box to check; they simply want to check their mind into survival mode and slide by. So, our real challenge and the foundational level is not Engineering details, nor is it Engineering concepts. It's motivation! We've addressed this challenge in other work and the interested reader can review that document for more details[9], but suffice to say, motivation is a challenging endeavor. It is possible, and we've seen promising results the past few years from our department.

Let's generalize our specific example to Classroom X and University Y. Instructor Z has the same challenges, perhaps in differing measures. Maybe his/her students can skip class if they want, albeit to the detriment of learning, but they would probably have more choice whether to enroll in the class or not depending on their major. Yet, the challenge remains. If the instructor wants to help that student transfer the material from short-term memory to long-term memory, they should seek to motivate the students. Think about it. When was the last time you remembered something, truly remembered it long-term, that you did not either take interest in or that you did not beat into your memory through countless hours of practice and repetition? Either way works, but we advocate the motivation/interest approach due to the limited contact hours in a given semester (or quarter).

Observation #9: Enthusiasm is a highly underrated attribute of successful instructors.

One way to motivate students is to demonstrate that you truly care about them and the material you are teaching. This leads us to our ninth observation that enthusiasm is a highly underrated attribute of successful instructors. Enthusiasm is contagious! If an instructor is enthusiastic about the subject matter, that enthusiasm will slowly bleed over to the students in the form of motivation and true learning.

Does this mean that every instructor needs to be a cheerleader at the front of the room and bounce off the walls? No. After all, if we graded a group of instructors, we would find successful instructors who were exuberant, vibrant, and active, and we'd find successful instructors who were reflective, methodical, and passive. What we're really talking about is the enthusiasm that comes from *passion*. A strong love or appreciation for your subject matter will manifest itself in the classroom regardless of personality. Now, for the students' sake, if your personality drives you to the monotone "Bueller Bueller Bueller" presentation, perhaps there's some improvement to be made at the personal level. But, students can tell when instructors care about their learning, and they can tell when instructors care about the topic of interest.

The good news is that most instructors would not be working in the classroom and with their particular subject matter unless they volunteered to do so. Thus, whether or not you are enthusiastic in the class is a matter of watering. The seed has already been planted!

Referring to our core Electrical Engineering course, the students are naturally trepidatious when they enter on Lesson 1. After all, it's engineering and they're not engineers. The best thing we can do on Lesson 1 is to smile and get them to start talking. Those two simple steps unlock two positive triggers in their learning: 1) they see the instructor is enthusiastic and passionate about class and the material, and 2) they are prone to more quickly ask questions throughout the semester.

Observation #10: The most important lessons students learn are not found in the syllabus.

Our tenth and final observation is indirectly related to those above in that it neither feeds nor is a by-product of any of them, but it is foundational to future success of every student. We observe that the most important lessons students learn are not found in the syllabus.

It's generally an unstated fact that an undergraduate degree provides breadth in its field of study, but it will not fully prepare you for your subsequent job. If it did, there would be no need for graduate school, on-the-job training (OJT), or junior mentoring. Thus, at the undergraduate level, we hopefully establish a foundation of concepts, tools, and topic rigor and breadth that a student can take to his/her job and serve as the springboard for technical proficiency. Yet, how many of us have known someone really smart in our organization that was not very successful? We all know at least one person like that (it may even be you). So, it's apparent that technical proficiency is not the only ingredient for success. In fact, we argue it's not even the predominant ingredient for success. In our experience from a collective 38 years in a myriad of different Air Force units, intangible attributes are almost always better predictors of future success. Intangible attributes such as teamwork, leadership, initiative, attitude, problem solving, critical thinking, perseverance, and organization are indispensible and serve as the core for all successful workers.

In our profession of arms, these attributes are even more vital for success. But, what do they have to do with the classroom? Everything! The classroom is the training ground for future success, and yes, it is where they develop technical proficiency. Look at any syllabus and you'll see exactly what proficiencies the instructor plans to develop. So, if the most important lessons students learn are not found in the syllabus, should they be in there and how should the instructor incorporate them or assess them in the classroom environment? The short answers are "no" and "purposely." No, these intangible attributes do not need to be present in the syllabus. After all, the syllabus just describes the course policies, procedures, guidelines, and a skeleton outline of topics. In Air Force lingo, it is the Tactics, Techniques, and Procedures (TTPs). Yet, every Air Force unit relies on leadership, teamwork, etc. for success and not just the TTPs. Similarly, the wise instructor should purposely introduce activities in the classroom that give students a chance to develop leadership, teamwork, etc. Some schools actually track these intangibles, perhaps through items such as critical thinking, as overarching objectives that are reported to ABET for accreditation. But, we're specifically targeting the individual classroom setting in this Observation. As an instructor, are we giving graded and non-graded events (e.g., in-class exercises, homework, projects, labs) for the students to practice these intangible attributes, and are we assessing them (through informal or formal feedback)? If not, we are failing them.

We admit that this certainly adds a burden to the instructor to tailor their class to practice and assess these intangible attributes. But, the future benefits of such efforts far outweigh the minor initial investments. Compare student A and student B. Student A attends class every day, sits in class, takes notes, listens to the teacher, does homework, takes tests, and passes the course, but that's it. Student B does the same but is forced to do a group project and serve as its leader thereby practicing teamwork and leadership. In that setting, Student B sees first-hand the impacts of different attitudes and levels of personal initiative. Furthermore, the project assignment calls for an open-ended answer giving them a chance to not only solve the problem but apply critical thinking in selecting an answer. The project may be difficult so they'll need perseverance; the project may require a report, briefing, or end product so they'll need to organize the results; and the project may be controversial so they'll need to support with documentation. After graduation, Students A and B are both hired by Google (or pick your favorite company). Student B will have such a tremendous advantage over Student A because he/she will have been practicing those intangible skills that Google will ask them to use on a daily basis.

Conclusion

This paper summarizes our common observations as first-year instructors despite coming from different backgrounds and possessing different interests. It's our wish list: what we wish we had known in the Summer 2010 when we began. Had we been aware of these observations before teaching, we could have more quickly adapted to the teaching environment. The observations are somewhat skewed based on our initial orientation on promoting a learning-center paradigm and environment, and we do not apologize for that. Student learning is the purpose of teaching. Regardless, we believe the observations remain universally applicable.

As previously mentioned, our top 10 observations also offer a few recommendations and ask a few open-ended questions, but we are by no means developing "Tricks of the Trade" or "Best Practices" for new teachers. Rather, we hope this paper serves to promote dialogue in other institutions and departments to collectively address these observations.

The views and opinions expressed in this article are those of the authors and do not necessarily reflect official policy or position of any agency of the U.S. Government.

Bibliography

1. "Demographic Profile of the Class of 2015," USAF Academy Directorate of Strategic Plans and Programs, Requirements, Assessments and Analyses, 2011.
2. Butler, Jeffrey and Darren Wilson, "Teaching Non-Engineers to Engineer," AC 2010-758, *ASEE Annual Conference*, Louisville, KY, June 2010.
3. Bain, Ken, What the Best College Teachers Do, Harvard University Press, Cambridge, MA, 2004.
4. Committee on Developments in the Science of Learning, How People Learn: Brain, Mind, Experience, and School: Expanded Edition, National Academy Press, Washington, DC, 2000.
5. Hanford, Emily, "Physicists Seek To Lose The Lecture As Teaching Tool," 1 January 2012, http://www.npr.org/2012/01/01/144550920/physicists-seek-to-lose-the-lecture-as-teaching-tool.
6. Rumelhart, D. E., and A. D. Norman, "Analogical processes in learning," in J. R. Anderson (Ed.), Cognitive Skills and Their Acquisition, Erlbaum, Hillsdale, NJ, 1981.
7. Kroppe, Joanne and Jackie Spradley, eds., Borders: Crossing Into Your Future: Third Edition, Hayden-McNeil Publishing, Plymouth, MI, 2011.
8. Kanar, Carol C., The Confident Student: Seventh Edition, Wadsworth Cengage, Boston, MA, 2011.
9. Hendrix, Constance, Marcus L. Roberts, Jeffrey Butler, and William Eccles, "Why Should They Care? Meeting the Challenges of Teaching Non-Engineers to Engineer," *ASEE Annual Conference*, San Antonio, TX, June 2012, accepted for publication.