Motivational Concepts and their Application to Students in Engineering And Construction Management

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Introduction

Precisely, what do we mean by the word "Motivation"? One dictionary defines motivation as providing a motive; another says to motivate is to excite. A third dictionary says to provide a force or stimulus or influence. When it comes to motivating a student, they all apply. However, motivation is not a personal trait one is born with. On the contrary, most of us are motivated by behavior and circumstances and not birth. In the equation of nature vs. nurture, motivation falls squarely in the nurture category. That's not to say some of us are not naturally more motivated than others but instead to say we are, more times than not, motivated by our environment especially the people around us. Also, lack of motivation is not the same as lazy and motivational direction is at least as important as motivation itself. Motivation is a result of the interaction between the individual and the situation. Motivation varies from person to person and within one person, from time to time and situation to situation. To motivate is to encourage or provoke.

Motivation is the process that accounts for an individual's intensity, direction, and persistence of effort toward attaining a goal. [1] Let us look at each element as it pertains to the student. "Intensity" is a measure of how hard a student tries. This is probably the one element we professors zero in on most often. How do I encourage my students to try harder? Perhaps it's a better variety of work, or more interesting work, or especially more challenging work. We'll come back to this but suffice to say I have found that raising the expectations not lowering them causes students to try harder. The second element is "direction". We want to motivate students in the direction that benefits them, not us. This means we have to know where they are going to know what benefits them. Are they going to graduate school or to the job market? Direction might be the difference between a two year community college and a four year program. The final dimension of motivation is "persistence". This is a measure of how long a student will maintain his effort without getting discouraged and giving up. Motivated students are very persistent even to extremes.

The Early Theories of Motivation

All of the early and contemporary theories of motivation were done for industry and not developed to study motivation of students. However, they apply as a stepping off point. The early theories were done in the 1950s and 1960s and are not as appropriate today as they were then. They are however no less valid in 2009 so long as we recognize that times have changed and motivation has also.

- **Hierarchy of Needs Theory**[2]
  This is the most well know theory published by Abraham Maslow in 1954. He felt that within each of us stood a pyramid of needs. He wrote that we started at the bottom and as

each need was satisfied we moved up to the next level which then became dominant until it was satisfied. The needs, from the bottom up, are as follows:

1. Physiological need: hunger, thirst, shelter, sex and bodily needs. This is logical and would apply to motivate employees but students are seldom in this category. This would have applied during the great depression when putting food on the table was, of course, a great motivator.
2. Safety need: security and protection from physical and emotional harm. This may be a motivator in a classroom but not in the context of being in jeopardy of physical harm. Instead, the student may feel in jeopardy of emotional harm from peer pressure or embarrassment.
3. Social need: affection, belongingness, acceptance and friendship. This does apply to the student since they have been weaned on the importance of belonging and acceptance. Sometimes, a student wants to "belong" to the in-crowd so much that the student behaves inappropriately in class to gain the favor of the others. However, this need can be used to improve behavior.
4. Esteem need: this would include self-respect, autonomy and achievement, status, recognition and attention. This is a level that students are motivated at and will be discussed further.
5. Self-actualization need: to become what one is capable of becoming. This includes growth, potential and self-improvement. This is where we want to take our students. If we succeed, the student is so self motivated that he needs little from us but encouragement.

Maslow wrote that our motivating someone starts by understanding at what level that person is and doing whatever it takes to satisfy that level so the person will naturally move up to the next level. He separated the need levels into lower-order and higher-order placing physiological and safety in the lower-order and social, esteem and self-actualization in the upper-order. This is based on the lower-order being satisfied externally and higher-order being satisfied internally. Applied to today's students, we must address the higher-order level since the others are already satisfied and are not affected by the professor to any real extent. Also, remember, in the higher order needs, the student is working on all of them together not one at a time as Maslow suggested. The student does not have to satisfy one need to work on the next. Imagine a young freshman, not sure who or what he is, now juggling the satisfaction of all these needs.

In 1969 and 1970, Clayton Alderfer revisited Maslow's Hierarchy Theory and reworked it into what he called his ERG Theory.[3] He had only three groups; "Existence" (physiological and safety), "Relatedness" (social) and "Growth" (esteem and self-actualization). Alderfer thought different about need satisfaction. He felt we work on all levels at once and do not have to satisfy one before we move on to the next.

- **Theory X and Theory Y** [4]

  This theory presupposes that there are two types of people (students) in the workplace and by extension, in the classroom. They are Type X, negative, and Type Y, positive. The categories are how the teacher views the student and what assumptions he makes about that student. If the student is a Type X, he is viewed as a person who dislikes what

he is doing and will try to avoid it if possible. Therefore he must be coerced or controlled to get his studies done. This student will avoid responsibility, and display little ambition. If the student is Type Y, he is viewed as a person, who likes his studies, exercises self direction, seeks responsibility and can be self innovative.
We might be tempted to see this as reality but remember this does not say the student "is" Type X or Type Y, but instead "is perceived" by the teacher as Type X or Type Y. This we will discuss later when we delve into culture and gender biases and how a Type Y student can be inspired.

- **The Two Factor Theory**
  This theory is sometimes called the "Motivation-Hygiene Theory". This is the work of Frederick Herzberg, who in 1958 and 1959 wrote that people's relationship to work is a basic premise. He felt that most people understood that hard work will determine success or failure.[5] Herzberg's Two Factors related people's response to whether they liked their job and ended with the categories of Satisfiers and Dis-satisfiers. Satisfiers were things such as advancement, recognition, responsibility and achievement while dis-satisfiers were supervision, reward, policies and work conditions. He felt satisfiers and dis-satisfiers are separate entities, therefore elimination of dis-satisfiers can bring peace but not satisfaction; peaceful harmony but not necessarily motivation.

  Students understand that hard work is related to success or failure. This theory fails in the classroom in many ways. The student who succeeds often takes the credit but the one who fails blames the teacher. In spite of the millennium generation's propensity for believing in "the world according to the media", they do understand that hard work is a precursor to success.

  The Contemporary Theories that came later tried to address some of the questions left partially answered by the Early Theories. For example, how do we awaken the Satisfier drives in our students? How do we connect students to their needs and get them to invest by seeing themselves as capable and believing in attainable satisfaction. We must convince students that positive behaviors are worth the effort, time and self-discipline.

Contemporary Theories

Although there are numerous contemporary theories only one directly reflects back to the early theories and has a series of needs listed as before. This is called McClelland's Theory of Needs.[6] His three needs were Achievement, Power and Affiliation. The Need to Achieve is the drive to excel, to beat the standards, to succeed. The Need for Power is the desire to make another behave as you wish. This need drives people into politics and is sometimes thought to be the easiest to corrupt. The Need for Affiliation is the desire for friendly and interpersonal relationships. This need is satisfied by the "joiner" type usually.

Only the Need to Achieve is directly applicable to the student / teacher relationship. Whether correct or not, we teach our students that achieving is necessary in a college curriculum and we measure this by the use of grades.

The major contemporary theories came later and are more generally accepted but not better proven.

- **Cognitive Evaluation Theory**

This theory supposes that extrinsic rewards and intrinsic rewards are somehow connected and not separate as previous theories have presumed. Simply put, the introduction of an extrinsic reward (grades) for work that was previously intrinsically rewarded by the pleasure of doing the work (research) tends to decrease and not increase overall motivation.[7] As this applies to the student, when grades are used to motivate someone for performing a task that someone already wanted to perform (such as research), that someone's internal interest in the task will decline. This is because the person feels a loss of control over the task he had chosen in the first place. Also, this person wants to control the "why" he or she works on this task. This is difficult to apply to the undergraduate student in an Engineering or Construction Management curriculum. There are negative and positive motivators (the carrot and the stick) and the student certainly needs to be motivated by both and therefore grades are a very important motivator at this undergraduate stage. However, at research universities, and especially at higher levels such as post graduate studies, I'm sure this has more validity.

- **The Goal-Setting Theory**

The Goal-Setting Theory is, in my experience, one of the most important theories. Setting a goal and then shooting for it has always made sense. But goals must be specific, set high but not too high, must be achievable, and must make sense to the student. Goal-setting theory has three components; they are goal specificity, challenge and feedback. A person's intension to work toward a specific goal is very motivating so long as it has these components. An unrealistic goal is equally de-motivating.

Goals must be specific. That is to say, a vague goal, such as the usual parent admonition to "do your best", is not specific enough to motivate too many individuals. We need something more specific such as a parent telling their son or daughter to set their sights on getting "A"s because graduate school may depend on it. Edwin Loche wrote in 1960 that a person's intention to work toward a goal that was specific, achievable and had feedback was a great motivator for most people.[8] He felt that goals not only tell the person what has to be done but they give a good approximation of the amount of effort required. Also, as well as goal setting works, it works better when the goal is higher rather than lower so long as the goal was accepted by the student. Higher, not lower expectations from the teacher are motivating. Students require feedback to be motivated so continuous interaction usually continuously motivates.

This, of course, begs the question, "Why are students more motivated by harder assignments than by easy ones?" The answer is threefold. First, the student is energized by the difficulty of the goal. Difficulty peaks interest. Second, he or she will persist longer and harder for a difficult goal that they accepted. Lastly, the student will feel elevated above classmates and somehow more important if their goal is harder than their classmates. This last phenomenon talks to the fact than the student will feel like he is smarter, or more experienced than a classmate and that is why he was given the loftier task. All of this is based on the student being committed to the goal in the first place. This commitment means the student will not

abandon the goal but instead will persist, and that he believes in the goal. Students sometimes only believe in the grade but not the value of the assignment. The mission then is to convince the student that he wants to prove himself to his professor and that doing so will further his education or make him somehow better suited to his chosen field.

When we motivate students by objectives, the goal must be specific with an explicit time period for completion, and it must have feedback with the inherent possibility of performing a similar task better next time.

- **Self-Efficacy Theory**

The Self-Efficacy Theory, sometimes called the Social Cognitive Theory, says the higher your confidence to accomplish a task the better your chances of succeeding at that task. Therefore, a low-confidence student will give up and a high-confidence student will be motivated by the same task. In fact, the assignment of a more difficult task to a high-confidence person motivates them to even higher confidence. So how does a teacher increase his student's confidence or self-efficacy? Albert Bandura wrote there are four channels to enhance self efficacy. [9] They are as follows:

1. Enactive Mastery: gaining relevant experience increases confidence. So students are asked to do homework problems in an engineering class to practice, practice, practice.
2. Vicarious Modeling: Seeing someone else do the task makes you confident that you can imitate the task. The teacher does numerous examples on the board each time encompassing more and more student input.
3. Verbal Persuasion: becoming convinced by being told you have these skills increases confidence. In this case, the teacher"builds-up" the student by verbal admonition that "he can do it". This usually must be followed up by positive feedback.
4. Arousal: Getting "psyched up" like a "pep talk", or a "rally". This is how motivational speakers work. This would be hard to apply to engineering students. However, getting them excited about being in an exciting business and that they are very close to being there certainly motivates seniors who are sometimes difficult to motivate. I sometimes have a senior who was once a freshman in my class years before and the change is often miraculous. He is "excited" about the nearby prospect of being "in the field".

This elevating of confidence is primary to motivation of students. Like the Pygmalion Effect, believing something to be true can make it become true. Perception is reality.

- Reinforcement Theory

This is somewhat the opposite of the Self-Efficacy Theory. This is a behavioral approach and states that a student is motivated by reinforcement and nothing more. That reinforcement is a direct consequence of the student's work effort. I'm saddened to say, this is somewhat the type of motivation professors have been fighting for years. Students only take interest in our subject when there is a consequence such as a good or bad grade. Basically, this ignores "what makes Johnny work" before the assignment but zeros in on how the consequence of "Johnny not working" will motivate him this time and next. A

failing grade on the first exam will motivate him to work much harder coming to the second exam. There is some truth to this but it would be better if he worked hard for both exams because he wants to understand the subject. Also, there is ample proof that he will retain less of what he learns when motivated this way. This leads into many questions about how we motivate vs. how we test. A topic for another day.

- **Equity Theory**

The students always inherently know this theory well although they have never studied it formally. Perception of equity or fairness is, at least, as important as the subject itself. Students compare themselves to other students. They compare their input and outcome to others and are de-motivated if they feel they were not treated fairly. If they feel they were treated fairly, it's not mentioned. In fact, it's taken for granted and should be. But, if they feel they were treated poorly compared to another they are de-motivated but the opposite is not necessarily true. If they feel they are treated better than another student, they are not necessarily motivated; in fact, they may be either motivated or de-motivated. They sometimes feel discouraged and think the entire system doesn't work. Again, how we test and grade enters into this feeling of equity.

Avoidance of the feeling of inequity is paramount in the classroom. Students should always feel they are being treated (graded) equitably. They will accuse the professor of inequity due to culture bias, gender bias, or anything else that will explain away a bad grade. Admitting there is no teacher bias is to admit the student didn't do well on his own.

In the workplace, we usually have some form of organizational justice. This would set in place a system of reward for effort. For example, a person might be paid based on seniority or number of hours worked or based on piecework. In the classroom, the student's pay (grades) should have some easily discernable yardstick. The professor should tell the students how their grade will be earned at the opening of the semester and stick to it.

- **Expectancy Theory**

Today's contemporary theories are capped off by Expectancy Theory. It appears for now to be the most comprehensive and the best fit to the student. This theory was developed by Victor Vroom in the middle 1960s and states "the strength of a tendency to act in a certain way depends on the strength of an expectation that the act will be followed by a given outcome and on the attractiveness of that outcome on the individual". [10] Basically, students will be motivated to a higher level of effort when they believe this effort will lead to better grades which will in turn satisfy the student's personal goals. This is two separate and distinct interfaces which must be satisfied. The student will work harder for better grades only if the better grades will lead to satisfying the student's personal goal. If the student's personal goal is not satisfied by the better grades he will not put out the effort.

This takes us back to understanding the student's personal goals. Two examples will make this clear.

1. An Architectural student told me she works hard for better grades because they will be her ticket to a top notch graduate school. The higher grades obviously satisfy her personal goal of getting into graduate school. She takes 15 credits per semester, joins and participates in various clubs and doesn't work outside of school.
2. A Construction Management student told me he is already working in his field and his grades do not matter so long as he graduates quickly so he can travel for his company. Obviously, higher grades do not matter to him. He is taking 21 credits, joins nothing and works full time.

Which student will get more out of his or her education? Will it matter in a long run? Understanding the personal goals of the students in your class is sometimes difficult. Each student has a different goal and each one may change his or her goal as their education continues.

Motivating the Student

- **Are Students inherently lazy; teacher's expectations?**
  I am sure there are students that fall into the category of "lazy". Students, like employees, range the full spectrum from very industrious to very lazy. The mission in the classroom is to raise the effort level of "lazy" students while not losing the engagement of the other students in the class. The teacher must know his students. He must "size them up" pretty quickly at the beginning of the semester and set the courses expectations at the correct level. By any reasonable measure, the "best" teachers expect "more" rather than "less" of their students, but piling on the work beyond their capacity is de-motivating.[11] It should also be said that most student's level of effort can be raised but there is no one procedure to reach them all. Also, certain material must be covered so allowing lazy or slow students to set the pace may be a pace that is too slow and therefore does not complete the required work or bores the better student.

  This leads us into the question of "How much homework should they do outside the classroom?" We tell students, the ratio of homework to class hours should be about three to one. My students and my children tell me this is unheard of in this day and age. There is so much else going on in their lives that they hardly read the text book and depend mostly on the teacher's ability to lecture. Is this fair to the teacher? Will this serve them well? I think not. We must motivate them to go back to doing more for themselves. Our job is to teach students to LEARN HOW TO LEARN. If we graduate a class of self-learners we have succeeded because they will spend their lives learning as their profession grows and changes. We must equate self learning with self satisfaction and self esteem.

- **Cultural Background and Gender**
  Cultural backgrounds and gender affect learning and how we motivate our students. E.A. Loche published his study as late as 1998 and he found goal setting works in some cultures better than others. He found performance is not the same yardstick in all cultures. Gender also effects how students are motivated. Our curriculum is male dominated (about 85% male) and at the college level, male students are often less emotionally mature than their female counterparts. The female students seem to be easier

to motivate perhaps because they are in a male dominated profession. I'm told the opposite is true in the School of Nursing. Sometimes, those in the minority try harder.

Remember, the early Type X and Type Y Theory presupposed there are two types of students in the classroom. Also, remember, the categories are how the teacher views the student and what assumptions he makes about that student. A Type X student is viewed as a person who dislikes school work and will try to avoid it. Therefore he must be coerced or controlled. This student will avoid responsibility, and display little ambition. A Type Y student is viewed as a person who likes his studies, exercises self direction, seeks responsibility and can be self innovative. There is evidence this varies from culture to culture and by gender but how much is debatable and varies with time in the American system. Also, remember this is the teacher's perception more than reality.

- **Goals vs. Grades as Motivators**
  When I can convince students that the goal is to gather as many "tools" as possible for their future in our industry, they are motivated to do the work and the grades take care of themselves. This is often accomplished by student professional clubs, experiential learning activities and group projects that are directly associated with their field. When the grade is the only motivation, the student's effort is less and the student's retention is low. Grades have their place, of course. The grading system in any college is flawed but they do attempt to tell us if the student has the motivation, skill, knowledge and ability needed to do well in a certain field.[12] Some students do not belong in the field of study they are in and should change curriculums. I am personally convinced that "marking on a curve" is a horrible de-motivator. My best performing classes are told that I do not mark on a curve, that people are allowed to fail and that expectations are high. The students today are bright, enthusiastic and smart. Challenging them with high but reasonable expectations and then convincing them that "we" can do it seems to be the best model. It doesn't take me long to convince them that we (they and I) can do it. I am available to them, I come early and do problems for them, I stay late and do problems on the board and my office door is always open. And they come regularly. My enthusiasm for the subject is contagious. I wish I could say I reach them all like this but that would be untrue. The students I reach quickly become self-learners and eventually see me as a fountain of "tools" and "information" that they desire.

- **Student-Centered Learning**
  The subject of "self-learners," is in fact, where today's educators are going. We are trying to teach students to be self-learners in college and throughout their lives. We do this through student-centered learning. Student-Centered learning is an approach to education focusing on the needs of the student, rather than those of others involved in the education process, such as teachers and administrators.[13] This is a major change of direction for today's teachers. The professor becomes a facilitator not a lecturer. The students choose the relevance, content and sometimes even the goals of the course. The students must be active, responsible participants in their own learning. The theory is, students will learn and retain much more if they teach themselves with guidance from the professor. The implementation of this type of teaching may be difficult. Remember, the students must be self motivated, the goals they set must meet the goals of the institution

and must cover the syllabus and finally, there must be some way to assess the value of whatever they learned.

- **Rewards other than grades, student recognition**
  Rewards, other than grades, are great motivators. Student recognition will always go further to motivate a student than grades. Unfortunately, most student recognition is based on better grades. We bestow scholarships, awards, prizes and even privileged status on the students almost always based on the best grades. That's the official student recognition. A professor can bestow recognition on a student in class too. Speak to students as if they are equal partners in the industry. Let them choose their own topics to research, have them set up their own groups and run their own clubs. Even have them decide which topics will be covered so long as overall the full syllabus is covered.

  Today's student has a need for self-esteem. Too many freshmen cannot make the self-esteem transition from high school to college and fail because of it. This would, of course, include self-respect, autonomy, feeling of achievement, status amongst his peers, recognition and attention from peers and teacher. All of these attributes change from high school to college, from parent's kitchen table to college classroom.

- **Student's ability and challenging work.**
  Student's ability may vary but within a reasonable range challenging work is a super motivator. All of the above studies found two important points about motivation. First, there is a range in which most students can be reached. Outside this range, low ability students are lost or high ability students are bored. The professor must find this range and set up his program to be here. Secondly, challenging work is a better motivator than easy work. All the above sited studies found that there is such a range and finding it is imperative. In fact, studies have found that repetitive tasks get so boring that some manufacturers found people resorted to sabotaging the work. This does not apply to the student since grades are always the ultimate motivator. Again, the professor must find the level of "challenge" that neither overwhelms low ability students, nor bores high ability students.

- **Peer pressure**
  There is no doubt that peer pressure works to motivate most students. The avoidance of embarrassment seems to be in direct correlation with Maslow's Safety Need. It's not the avoidance of physical harm but the avoidance of emotional harm; that is, embarrassment. This has some interesting dynamics as a motivator. The professor can use "peer review" to allow students to read one another's paper. They write at a higher level when it is known in advance that their peers will read their paper. In Construction Management classes we use low and high stakes writing to interest the students in the subject. They do better and more meaningful research when their peers are about to read and comment on their paper. I allow constructive, positive comments only. We also do an oral presentation of their research and the competition is heavy. They want to do it well. Then, there is simply the peer pressure in everyday class. Students want their classmates to think they are in control. This can be used by the professor to lead a student to better work. I have had the experience of changing the worst behaved student (he's too cool to

care about the subject) into the best behaved student (he's still cool but now it's cool to understand the subject) in one semester. I am willing to joke, cajole, be animated, tell stories, or be friendly to win him over. Most students are very sensitive to how their peers perceive them in relation to the professor and the overall class.

- **Motivation manipulation**
  Is "motivation" manipulation? YES. Motivation provides a motive to do something. It excites, stimulates and influences the student to a particular outcome. In the business community this may be seen as manipulation for the company's profit, not necessarily benefiting the employee, so it seems negative behavior but in the academic world, the profit is to the student so this is not thought of as a negative at all. In fact, if we "manipulate" a person by exciting, stimulating, or influencing them to an outcome in which they are the recipient of the benefit, motivation is positive and worthwhile. Students want to achieve self-actualization. They want to become all they are capable of becoming. This includes self-growth, full development of their potential and a full range of self-improvement. When in the process of self actualization, the student is self motivated and needs only encouragement.

- **Experiential Learning / group dynamics as motivators**
  The best motivation seems to be through experiential learning. When we show students real life situations and how mastery of their school work better prepares them to handle a real life situation, they are motivated for all the right reasons and to the highest degree. What they learn this way they retain.

  One of the most important, and most difficult, real life experiences is group dynamics. Once we go to work in industry, we must interact with people everyday. One's own outcome is directly connected to the group's outcome. Working with others is more difficult than the students know until they try it. When they work in a group they each become a motivator. They each need to motivate the others in the group to achieve a good final product. The ultimate level of being motivated is to become the motivator.

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